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Vol. XVI.

JULY, 1921.



Engineering

ENGINE STORAGE

Transactions of the Mining and Geological Institute of India.

Edited by
The Honorary Treasurer.

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The RECORDS of the GEOLOGICAL SURVEY of INDIA

Can be obtained by regular subscribers at the rate
of Rs. 2 per volume of four parts, distributed
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VOLUME LI.

Part 1. General Report of the Geological Survey of India for the year 1919. Note on Pseudo-crystals of Graphite from Travancore. On a Mineral related to Xenotime from the Manbhum District, Bihar and Orissa Province. On the Coal Seams of the Foot-Hills of the Arakan Yoma, between Letpan Yaw in Pakokku and Ngape in Minbu, Upper Burma. Observations on "Physa Prinsepia" Sowerby and on a Clionid Sponge that Burrowed in its Shell.

Part 2. Classification of the recent and fossil Cypræidae. Sulphur near the Confluence of the Greater Zab with the Tigris, Mesopotamia. Miscellaneous Notes—Note on Monazite in the Southern Shan States. Note on an occurrence of Graptolites in the Southern Shan States. The growth of an efflorescence of Cerium sulphate on Travancore Graphite.

Part 3. (In the press.) The Mineral Production of India during 1919. Results of a Revision of Dr. Noetling's Second Monograph on the Tertiary Fauna of Burma. Note on the Marine Fossils collected by Mr. Pinfold in the Garo Hills.

Part 4. (In the press.) Illustrated comparative Diagnoses of Fossil Terebridae from Burma. Indian Fossil Viviparae. On a new fossil Unionid from the Intertrappean beds of Peninsular India. Unionidae from the Miocene of Burma.

*Applications for any of the above should be made to The Head
Clerk, Geological Survey of India, 27, Chowringhee,
Calcutta.*

Transactions of the Mining
and Geological Institute of
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June 25,

Transactions of the Mining and Geological Institute of India.

Part 1

1921.

[July.

Annual General Meeting.

Calcutta, 11th February, 1921.

The fifteenth Annual Meeting of the Mining and Geological Institute of India was held on Friday, the 11th February, 1921, at 10-30 A.M. in the Lecture Room of the Asiatic Society of Bengal, Calcutta. The President, Mr. R. R. Simpson, was in the chair, and the following members and visitors were present:—

Mr. D. A. Anderson, Rai A. C. Banerjee Bahadur, Messrs. R. Barrowman, J. Bullock, L. M. Choudhuri, S. Eustace, Glen George, B. Heaton, C. A. John Hendry, Jhaverilal K. Dholakia, J. H. Lang, G. Miller, J. Miller, N. N. Mukherjee, N. H. Ojha, Jas. A. Oliver, Guy E. Pilgrim, E. H. Robertson, F.L.G. Simpson, H. M. Tarlton, J. Thomas and J. B. Wardlaw—*Members.*

Messrs. Jadulal K. Dholakia and P. C. Lawson—*Visitors.*

The President after declaring the meeting open, appointed Messrs. J. H. Lang and J. Miller as scrutineers of the voting papers for the President and other officers of Council for the forthcoming year.

Mr. Glen George said he rose to perform the sad

duty of proposing that the deepest sympathy of members of the Institute be accorded to Mrs. G. F. Adams and her daughter on the sorrow that had fallen upon them. The members sympathised with them the more keenly as they all felt the same sorrow. Apart from the loss that Mr. Adam's death entailed to the Institute and to Indian Mining there had gone from amongst them a personal friend. His charm of manner endeared Mr. Adams to them all. He placed his advice and services at the disposal of all of them. His services as an Inspector of Mines and subsequently as Chief Inspector of Mines had been great, and there had probably been no one connected with Indian Mining who had exercised so great an influence for good. His eighteen years of service in India were years of earnest, conscientious and efficient work. He (the speaker) was afraid that in the early days of the Mines Act in India most of them failed to realise what a friend they had in the Mines Department, and the fact that to-day they realised all that co-operation with the Mining Department meant had been due very largely to the charm and courtesy of Mr. Adams. The most conceited of them felt that they had with them a man who knew more about mining than they did. He might speak at length of the great services of Mr. Adams and he was sure that he was voicing their feelings when he said that a friend had gone from among them. He moved that the deepest sympathy of the members of the Institute be accorded to Mrs. Adams and her daughter.

Mr. Eustace seconded the resolution which was unanimously carried, the members standing in silence.

The President observed that a suitable memoir would be inserted in the transactions.

Mr. B. Heaton rose to propose a vote of sympathy

with the family of the late Sir Ralph Ashton, who had lately passed from them. He was a senior partner in Messrs. Kilburn and Company and was associated in the foundation of the Institute, of which he was president in 1911. He was one of that class of business men to whom India owed so much. He was always ready to take his part in public affairs and was a member of many important bodies. The opinion that was held by Government of his work for the public was shown when they knighted him.

Mr. A. C. Banerjee seconded the resolution. He had the honour of knowing Sir Ralph Ashton for a long time. His (the speaker's) uncle was a great friend of Sir Ralph Ashton and, as a boy, he remembered that they used to go to the mines and talk on diverse subjects. From that time the speaker had a great regard for Sir Ralph, which ripened into intimacy when he was their President. With these few words, and especially on behalf of the Indian section he seconded the resolution of condolence, which was carried unanimously, the members standing in silence.

The Honorary Secretary then read the minutes of the last Annual Meeting held on the 30th January, 1920, and of the last ordinary general meeting held on the 1st November, 1920, both of which were passed and signed by the President.

The Report of Council for the year 1920 was then read as follows:—

REPORT OF COUNCIL.

The Council have the honour to present the fifteenth Annual Report on the working of the Mining and Geological Institute of India.

2. The total number of members at the close of the year was 302 as against 283 at the close of the previous year. The additions to the register and the losses by

resignation, death, etc., for the past five years are shewn in the following table :—

	1916	1917	1918	1919	1920
Additions	.. 10	9	27	25	33
Losses ..	.. 25	13	6	20	14
Gain .		..	21	5	19
Loss ..	.. 15	4	..	..	..

The following is an abstract of the membership of the Institute :—

	1916	1917	1918	1919	1920
Ordinary Members	205	201	205	202	201
Associate ..	13	13	30	39	53
Associates ..	6	5	5	5	9
Honorary Members	10	12	12	11	12
Subscribers ..	27	26	26	26	27

From the above it will be seen that there is a diminution of one in the number of Ordinary Members compared with last year. The number of Ordinary Members elected was 18, but as four have not yet paid their fees, the actual number joining is 14. On the other hand 7 have resigned, 3 have died, 4 have been struck off under Rule 14, and the name of Mr. H. G. Graves has been removed from the list of Ordinary Members, as he has been recently elected an Honorary Member. The number of Associate Members joining was 14, of whom one was elected in 1919 and joined during the year. Four Associates joined during the year. One Honorary Member and one subscriber have been added to their respective lists.

3. The following members joined during the year :—

Names.	Qualifications.
1. Archer, Clement John ..	Mining Engineer. Certified Colliery Manager, Sripur Colliery, Kali-pahari, E.I.R.
Bhattacharjee, Surath Nath	Holder of 1st Class Colliery Managers' Certificate under Indian Mines Act. Lower Jharia Colliery, Jharia, E.I.R.

Names.	Qualifications.
3. Foster, James Gibson ..	Civil and Mining Engineer. Graduate in Civil Engineering, 4, Fairlie Place, Calcutta.
4. Harding, Joseph Gerald ..	M.I.Mn.En. Junior. Inspector of Mines in India, Dhanbad, E.I.Ry.,
5. Hines, Gordon Ewart ..	Colliery Superintendent, Assam Rys. and Trading Co., Ltd., Margherita.
6. Kirk, John ..	Mining Superintendent, Kustore Manbhum.
7. McArthur, John ..	Mining Engineer. Holder of 1st Class Colliery Managers' Certificate and that of Mine Surveyors, Lodna, E.I.Ry.
8. McDermott, Edward Duffield	Mining Engineer, A.R.S.M., M.I.M.M., M.A.I.M.E. Superintendent, Cape Copper Co., Ltd., Rakha Mines P.O., Singbhum.
9. Mirza, Khurshid ..	Mining Engineer. Graduate of Durham University, B.Sc., C.E., A.I.M.E. Inspector of Mines, Hyderabad.
10. Morgan, Joseph Tudor ..	Holder of 1st Class Mine Managers' Certificate of Competency under British Coal Mines Act. Teetulmuree Colliery, Sijua, Manbhum.
11. Mukherjee, Tarak Nath ..	Holder of 1st Class Mine Managers' Certificate of Competency under Indian Mines Act. Colliery Manager, West Laikdih Colliery, Nirshachetty P.O., Manbhum.
12. Sircar, Narendra Nath ..	Holder of 1st Class Mine Managers' Certificate of Competency under Indian Mines Act. Colliery Manager, South Kujama Colliery, Jharia, E.I.R. [wan.
13. Sellers, Douglas ..	Mining Engineer, Charanpore, Burd-
14 Weir, Walter ..	Civil and Mining Engineer. Holder of 1st Class Home Office Certificate.

Names.

Qualifications.

M.I.Mn.En. Colliery Superintendent Bengal Iron Co., Ltd., Kulti, E.I.R.

Associate Members.

1. Allah Ditta .. Mining Assistant, Jealgoro Colliery, Jamadoba, Manbhum.
2. Banerjee, Jotindra Nath .. Holder of 2nd Class Mine Managers' Certificate. Manager, Khoodia Colliery, Mugma, E.I.R.
3. Bose, Sailendra Nath .. Mining Assistant, Camp Sathgram, Raniganj, E.I.R.
4. Dave, Harishankar H. .. Holder of 2nd Class Mine Managers' Certificate. Khas Jharia Colliery, Jharia, E.I.R.
5. Davis, Percy Bardford .. Assistant Coke Oven Manager, Lodna Colliery, Jharia, E.I.R.
6. Ghosh, Sushil Chandra .. Colliery Proprietor and Merchant. C/o Universal Trading Co., 33, Canning Street, Calcutta.
7. Bhatt, Girijashankar Amba-shankar Mining Diploma Holder, B.E. College, Sibpur. Assistant Manager, South Jharia Colliery, Jharia, Manbhum.
8. Guha, Manickia Chandra .. Holder of 2nd Class Mine Managers' Certificate of Competency. Colliery Manager, Kohinoor Colliery, Bhujudih, B.N.R.
9. Mondol, Rash Behari .. Instructor in Mine Surveying, B.E. College, Sibpur.
10. Ratsurana, Mauik Chandra Merchant. 8, Old Court House Corner, Calcutta.
11. Singh, Karam Holder of 2nd Class Mine Managers' Certificate. Assistant Manager, Sor Colliery, Quetta, Baluchistan.
12. Sircar, Binuty Bhusan .. Assistant in charge, Sircar's Paras-cole Colliery, Raniganj, E.I.R.
13. Thomas, Tom David Ballard Constructional Engineer, Bararee

Names.	Qualifications.
	Coke Co., Ltd., South Bulliarea Colliery, Kusunda.
14. Williams, James Emmanuel	Holder of 2nd Class Colliery Managers' Certificate of Service. Assistant Manager, Lodna Colliery, Jharia, E I.R.

Associates.

1. Rai, Shiv Nath	.. Agent, Jamadoba and Dugda Khas Collieries, Jharia, E I.R.
2. Thacker, D. D.	.. Colliery Agent. Managing Partner, Pure Jharia Colliery, Jharia, E.I.R.
3. Thompson, Dr. G. W.	.. Chief Sanitary Officer, Jharia Mines Board of Health, Dhanbad, E.I.R.
4. Tomb, Dr. J. W.	.. Chief Sanitary Officer, Asansol Mines Board of Health, Asansol.

Subscribers.

- Assam Railway and Trading Co., Ltd., Rehabari P.O., Upper Assam.

Honorary Members.

The name of Mr. H. G. Graves has been transferred from the list of Ordinary Members to that of Honorary Members.

4. Seven members have resigned :—Messrs. P. Brühl, F. Dufton, J. B. Gibb, A. H. Izat, E. D. James, H. T. Thomson and W. J. Wood. The Council note with regret the loss by death of Messrs. H. A. Lyon, J. A. Millar and H. J. Sparkes.

5. The following names have been removed from the list of members under Rule 14 of the Articles of Association :—Messrs. W. Beckett, R. F. Campbell, J. H. Evans and W. Stonor.

6. Meetings of the Institute were held as follows :—

Annual General Meeting,	Calcutta, January 30th, 1920.
First Ordinary General Meeting.	Jharia, March 8th, 1920.

Second Ordinary General Meeting, Asansol, July 19th, 1920.

Third ,, ,, ,, Jharia, September 13th, 1920.

Fourth ,, ,, ,, Kusunda, October 11th, 1920.

Fifth ,, ,, ,, Asansol, November 1st, 1920.

At the first Ordinary General Meeting, the members visited Messrs. Tata Iron & Steel Co., Ltd.'s Jamadoba Colliery at Jharia where they inspected the coal cutting machines at work. The second, third and fifth were held for the reading and discussion of papers. The fourth took the form of a geological excursion for the purpose of examining the coal outcrops in the vicinity of Gandudih, Godhur and Dhariajoba in the Jharia coal-field.

7. The following papers were read and discussed :—

- (a) Note on the Correlation of the Gandudih, Dhariajoba and West Godhur Seams, Jharia Coal-field. By J. Thomas.
- (b) Proposed Method of Working a Highly Inclined Thick Seam of Coal. By E. H. Roberton.
- (c) Preliminary Note on the Ventilation of Indian Mines. By F. L. G. Simpson.
- (d) Hydraulic Packing in Thick Coal Seams. By H. M. Tarlton.
- (e) Suggestions for the Improvement of Labour Conditions at Indian Coal Mines, and for Labour Saving. By W. Simmons.
- (f) The Extraction of Pillars in a Thick Seam in the Jharia Coal-field. By N. N. Sarkar.

The following papers have also been accepted for publication :—

- (a) Accidents in Indian Mines, and Mining Legislation. By R. R. Simpson.
- (b) Additional notes on the Geology of Guzerat. By Edwin J. Beer.

8. Two parts of the Transactions have been published, forming part 2 of Vol. XIV and part I of Vol. XV. Vol. XIV, part 2, was issued to members on June 9th, and Vol. XV, part I, on November 6th, 1920.

9. Six Council meetings were held during the year for the election of members and transaction of the current business of the Institute.

10. The geological map of the Jharia Coal-field, complete in 8 sheets, on a scale of 4" to the mile, which is the outcome of the work of several years of the Jharia Map Committee, has been published. The price is Rs. 36 per set, or Rs. 6 per sheet, if odd sheets are purchased.

11. The Subsidence Committee consisted of :—

Mr. Glen George, Chair-	Mr. F. Owen.
man.	„ A. B. Hughes
„ R. G. M. Bathgate.	and
„ G. C. Leach.	„ G. F. Adams (Honorary
„ P. S. Keelan.	Secretary).

Mr. R. R. Simpson officiated as Honorary Secretary when Mr. Adams went on leave from 1st May. Mr. J. G. Harding, and later Mr. J. H. Lang, assisted the Honorary Secretary. The thanks of the Committee are tendered to these gentlemen.

During the year eleven cases were under observation. Only one new case was taken up.

In 1918 the Committee were of opinion that sufficient information in regard to subsidences in shallow seams had been obtained, and that no further cases at a depth of less than 500 feet should be taken up. Members are requested to bring to the notice of the Honorary Secretary cases where goafing is being carried on at depths not less than 500 feet.

12. The prize offered by the Government of India for the best paper accepted for publication in the Transactions of the Institute was awarded to Mr. J. Brown for

his paper "Quarrying a Thick Coal Seam in India, with notes on Haulage and Drainage."

13. Institute medals. The three medals offered for the best papers read before the Institute were awarded as follows:—

- (a) The gold medal to Mr. J. Brown for his above-mentioned paper;
- (b) The silver medal to Mr. C. A. John Hendry for his paper on "Proposed Sand Packing at Ramnagar"; and
- (c) The bronze medal to Mr. G. W. Marshall for his paper on "By-Product Coke Ovens."

14. The following is the financial statement for the year 1920. The revenue of the Institute for the year was Rs. 13,846-13-5. Of this amount Rs. 6,706-10-8 was derived from subscriptions, as compared with Rs. 6,483-5-4 in the previous year. The sale of Transactions, maps and advertisements realised Rs. 2,808-14-6, as compared with Rs. 615-11-9; and the amount realised for interest was Rs. 2,531-4-3, as compared with Rs. 2,139-4-0. The subscription of 250 members were fully paid up as against 235 at the corresponding date last year. The subscriptions outstanding amount to Rs. 1,010.

The expenditure was Rs. 11,556-7-3 as against Rs. 8,370-6-10 in the previous year. Increases are shown under almost all the headings. The greatest increase is in that of the Jharia Map account. This is owing to the printing having been done in 1920. There has been a decrease under the heads of Advertising and Printing and General Charges. A sum of Rs. 270 has been written off on account of subscriptions not recoverable as against Rs. 930 in the previous year.

MINING AND GEOLOGICAL, INSTITUTE OF INDIA.

[illegible]

We hereby certify that we have examined the Books and Accounts of the Mining and Geological Institute of India with the vouchers for the year ended 31st December, 1920, and have found them correct. In our opinion the above Balance Sheet is drawn up in conformity with the law and exhibits a true and correct view of the position of the Institute to the best of our information and the explanations given to us and as shown by the books.

Calcutta, 5th February, 1921.

MINING AND GEOLOGICAL INSTITUTE OF INDIA.

Income and Expenditure Account for the year ended 31st December, 1920.

EXPENDITURE.	Rs.	A. P.	Rs.	A. P.	INCOME.	Rs.	A. P.	Rs.	A. P.
To Advertising, Printing and Stationery	..	...	447	1 9	By Subscriptions—				
„ Printing of Transactions	..	...	1,624	15 6	175 Ordinary Members @ 30/- each	5,250	0 0		
„ Charges, General	..	...	323	1 9	1 „ Member @ 15/-	15	0 0		
„ Establishment	..	...	1,636	0 0	49 Associate Members @ 10/- each	490	0 0		
„ Expenses of Meetings	..	...	228	2 0	1 „ Member @ 5 -	5	0 0		
„ Postage and Telegrams	..	...	360	4 0	9 Associates Members @ 30/- each	270	0 0		
„ Audit Fee	..	...	100	0 0	27 Subscribers	676	10 8	6,706	10 8
„ Subsidence Committee	..	...	1,947	8 2	„ Interest	..	...	2,531	4 3
„ Jharia Coal-field Geological Map Account	..	...	3,071	0 6	„ Advertisement and Sale of Books..	..	...	315	14 6
„ Dinner Account	..	...	592	0 0	„ Sale of Raniganj Coal-field Maps ..	..	...	753	0 0
„ Institute Medals	..	...	654	7 10	„ „ „ Jharia	..	...	1,740	0 0
„ Subscriptions written off	..	...	270	0 0	„ Subsidence Committee Grants	..	...	1,800	0 0
„ Depreciation written off : Books	..	...	67	9 5					
„ „ „ Furniture..	..	...	176	4 4					
„ Insurance	..	...	55	0 0					
„ Law Charges	..	...	3	0 0					
„ Balance transferred to Balance Sheet	..	...	2,290	6 2					
TOTAL, Rs.	..	...	13,846	13 5	TOTAL, Rs.	..	...	13,846	13 5

Examined and found correct.

Calcutta, 5th February, 1921.

(Sd.) LOVELOCK & LEWES. Chartered Accountants, Auditors.

The Subsidence Committee account is shown separately as below :—

SUBSIDENCE COMMITTEE.

RECEIPTS.	RS.	A.	P.	EXPENDITURE.	RS.	A.	P.
To Balance of last year ..	561	10	6	By Amount disbursed in 1920	1,947	8	2
„ Amount received in 1920	1,200	0	0	„ Balance in hand ..	414	2	4
„ Amount due ..	600	0	0				
	2,361	10	6		2,361	10	6

The President remarked that they would notice that things were in a flourishing condition. He moved that the report as read and the accounts as put before the members be passed and adopted; this was seconded by Mr. J. Thomas, and carried unanimously.

The Prize Committee reported that the Institute Gold Medal had been awarded to Mr. E. H. Robertson for his paper “Proposed Method of Working a Highly Inclined Thick Seam of Coal”; the Silver Medal to Mr. H. M. Tarlton for his paper entitled “Hydraulic Packing in Thick Coal Seams”; and the Bronze Medal to Mr. R. R. Simpson for his paper “Accidents in Indian Mines, and Mining Legislation.” The Government Prize of Rs. 500 for the year was recommended to be divided equally between Messrs. E. H. Robertson and H. M. Tarlton.

The Honorary Secretary reported the result of voting for officers, and the following were declared duly elected :—

President :

Geo. Miller, Mining Engineer, Indian Iron and Steel Co., Ltd.

Vice-Presidents :

B. Heaton, Principal, Bengal Engineering College, Sibpur.

J. S. Kean, Superintendent, Pench Valley Coal Co., Ltd.

Honorary Treasurer and Editor of Transactions :

E. H. Pascoe, M.A. (Cantab), D.Sc. (Lond.), F.G.S., Offg. Director,
Geological Survey of India.

Honorary Secretary :

E. H. Robertson, M.Sc., M.I.M.E., F.G.S., Professor of Mining, B.E.
College, Sibpur.

Members of Council :

H. M. Bull, M.I.M.E., Superintendent, Messrs. McLeod & Co.'s
Collieries.

Geo. Crawford, General Manager, Messrs. Burn & Co.'s Potteries.

A. T. Creet, General Manager, Ghusick and Musila Collieries.

Glen George, B.Sc., A.M.I.C.E., Messrs. Villiers, Ltd.

Alec B. Hughes, Mining Engineer, B.N. Railway.

L. A. Jacobs, B.Sc., M.I.M.E., General Manager, Ghusick Collieries.

J. Kirk, Chief Mining Engineer, Messrs. Tata Iron and Steel Co.,
Ltd.'s Kustore Collieries

E. D. McDermott, A.R.S.M., M.I.M.M., Superintendent, Cape Copper
Co., Ltd.

J. Mackie, General Manager, Eastern Coal Co., Ltd.

J. A. Oliver, General Manager, Bhutgoria Collieries.

Guy E. Pilgrim, D.Sc. (Lond.), F.G.S., Superintendent, Geological
Survey of India.

N. N. Sarkar, Manager, Kujama Collieries, Jharia.

E. S. Tarlton, Partner, Messrs. Bird & Co.

H. M. Tarlton, Superintendent, Barakar Coal Co., Ltd.

J. B. Wardlaw, Chief Mining Engineer, Bengal Coal Co., Ltd.

The new President, Mr. Miller, then took the chair.

Mr. Bullock proposed a vote of thanks to the retiring President and Council for their work.

Mr. Jhaverilal K. Dholakia, in seconding the proposal, said that they had had a very successful year, and that the excursions were very useful.

On the proposal of Mr. A. C. Banerjee, seconded by Mr. Eustace, Messrs. Lovelock and Lewes were re-elected auditors.

Mr. Miller then delivered his presidential address.

Presidential Address.

BY

Geo. Miller.

Gentlemen,—I thank you for the great honour you have conferred on me in electing me President of your Institute for this year, and in accepting office, I hope I may be able to justify the confidence you have placed in me in making your selection. I need hardly assure you that the interests of this Institute will have my best care, and with the willing co-operation of its members, I am hopeful of a year of office which may be full of interest.

You have just heard the report of the Council for the past year, and though it is gratifying to see a further increase of members and to be in a stronger financial position, there are still many who belong to the profession, whose names do not appear on the roll. Increase of membership however, though it may swell the funds, cannot be regarded as a measure of the Institute's success.

We welcome all new recruits, especially those who have just arrived from home to carry on their career amongst us; to such men our Institute should be invaluable, and they in their turn, imbued with the latest methods in vogue, are useful members to us, and I would call upon them to come forward and tell us how methods of mining in India might be improved. There is ample opportunity for improvement in every branch of mining. Let the Institute have the benefit of their suggestions.

The part taken in the proceedings by each individual

is the foundation on which the Institute stands, and more individual effort is wanted. It is wrong to say there are no subjects to write about, for our profession gives endless opportunities in this respect. Given the time, there is ample material to work on, and brains to deal with it are not wanting. The small encroachment on our leisure hours may be responsible for less work being done, but I hope each member will make the sacrifice and devote the spare time necessary to it. A paper need not be lengthy to be valuable and interesting; short papers often give opportunities for a very lengthy discussion. The Indian members of the Institute should also contribute; there are many subjects with which they are better qualified to deal, due to their more intimate acquaintance with the habits of the workers employed.

The function of a member is not merely to pay the annual subscription, which betimes is overlooked; he is expected to take his part in the work of the Institute, to get as much knowledge as he can from the members of it, and in turn to tell them what he knows. This can only be achieved by each member taking an intelligent interest in the reading of papers and in discussing them.

The past history of our Institute is one that we may feel justly proud of, when we consider the feeble child it was at birth (as one of our worthy Presidents once described it); it is creditable to those in whose hands it has been nursed and brought to such a strong manhood. It has grown in strength, and let us hope intelligence, and is still growing. I feel sure nothing now will retard that healthy expansion. Like all other children it may have suffered at times from illness due to inactivity, but it has been carefully nursed through it, and has regained strength and vigour. That nursing stage has now passed; yet it

may not be quite so robust as it should be and more physical and mental energy is to be expected from such a fine frame work. The zenith of its usefulness has not yet been achieved, and it is regrettable that more use is not made of it in all problems pertaining to the Mining industry, in which technical knowledge and practical experience are the means to a solution.

I should like here to refer to the regrettable loss the Institute has sustained by the death of one of its founders, Mr. G. F. Adams, late Chief Inspector of Mines, an officer who gave his best services to it, and who was known to all of you. His genial manner endeared him to everyone who met him, and I am sure no words of mine can add to the respect and high esteem, in which he was held by men of the profession, and particularly by the members of this Institute, with the formation of which he was so closely identified. Mr. Adams, as Chief Inspector of Mines came into personal contact with all men engaged in the Mining industry, and he gained their confidence by the practical view he took of the interpretation and application of the Mines Act, which it was his duty to enforce. We hope his successor may be a man similarly endowed with tact and consideration, with a practical knowledge of mining and with experience of Indian mining problems. As a token of the esteem in which Mr. Adams was held by the members of this Institute a letter of condolence will be sent to Mrs. Adams.

The annual report, of the Chief Inspector of Mines for the year ending 31st December 1919, has been very much delayed, and the reason for it appears on the opening page, namely the Press strike. We have advanced in this country ; strikes in all classes of industry have become common, but strikes in the coal-fields were unheard of until a few

months ago. Up till that time many of us would have been prepared to question their possibility, yet such have actually occurred. The germ has reached us, and if not promptly dealt with, will produce an epidemic. No combined action has, so far as I know, yet been taken, but it should not be too long delayed.

It is generally admitted, that the Mine Manager has always enjoyed the confidence and respect of those working under him. The miners' grievances and complaints were usually made the subject of a personal enquiry by him, and if found to be justified, promptly redressed. Miners' earnings have increased more than those of any other class of labour engaged, and the present conditions under which they work generally do not appear to justify a stoppage of work. Unfortunately too it has been found that increased rates per tub are invariably followed by a reduction of output per man; similar results have followed the increased rates at home. The methods adopted by the so-called labour leaders take a peculiar form quite unknown in any other country, and it is in this the danger appears to be. The spreading of dangerous propaganda in the bazaars and labour villages is the origin of the present discontent, and measures are necessary to prevent or counteract this movement. The effect this propaganda must have on the simple and credulous minds of the people should not be disregarded. The law, as it is presently framed, does not appear to be able to cope with this contingency, and I would suggest that an anti-propaganda be introduced to avert the dangers that must arise from the methods being adopted. It is too late to take action, when the whole industry of the country is paralysed for a political end which is undoubtedly the goal aimed at.

Continuing my remarks on the report just referred to, the coal mines again show an advance in output over 1918, but more persons were engaged in mining work to produce this increase. The application of machinery to the cutting and conveying of coal has not yet made much progress, but the subject is one which should receive the immediate attention of all those who are engaged in mining coal. Several machines have been successfully worked, and I would ask those members, under whose direction they are operating, to give the Institute the benefit of their experience.

Deeper mining, with costly equipment, necessitates larger and more constant outputs being maintained; to meet the charges on the capital costs involved in such enterprises, seems to require other methods of mining coal than those at present used. Mining legislation with reference to the employment of women and children underground is contemplated, and though it is necessary that such changes be introduced gradually, we must be prepared for them. The inevitable result of these regulations will be an immediate reduction of available mining labour, a corresponding reduction in output, and an increased mining cost. It is difficult to foresee exactly to what extent these two latter very important factors may be affected by the altering conditions, but I think it quite possible that the coal won by coal-cutting and coal-conveying machinery, will very soon be found to compete favourably with the cost of hand-won coal. The recent introduction of strike methods too amongst the mining community, may be one means of hastening the adoption of coal-cutting plant, and bringing it into more general use.

Dealing with mine accidents, the following remark appears in the report; "many of the accidents could have

been avoided by closer and more skilled supervision." The death-rate is given as 1·25 per 1,000 persons employed and for the preceding 5 years the rate was as low as 1·02. The death-rate for the United Kingdom over the 10 years ending 1918 was 1·51 per 1,000. When we take into consideration the crude material with which the Mine Manager in this country has to contend, and the lack of facilities for improving it, the death-rate does not compare unfavourably with that of the home mining industry. This lack of skilled supervision is regrettable, and no doubt there is evidence that want of it directly contributed to the accidents referred to. This brings more forcibly before us the want of facilities and opportunities for mining education in this country. The evening classes, now being held at the various mining centres and the School of Mines established by the Maharajah of Kossimbazaar at Ethora, have to some extent fulfilled this requirement but have by no means met completely the needs of our profession.

Some years ago three gentlemen, members of this Institute, were appointed by Government to proceed to England, to enquire into methods of mining education, and to report on the most suitable means by which they might be introduced in India. This resulted in a commission being appointed by Government to formulate a scheme. The commission recommended to Government that a School of Mines, situated in a mining centre, should be proceeded with, but unfortunately the war delayed the carrying out of these recommendations. The matter has again engaged the attention of Government, and the suggestions made by the commission are now about to take practical form, and we hope to have a School of Mines established in the coal-fields in the near future.

In the report of this commission, it was recommended

that the staff of the Sibpore College Mining Section should be transferred to form the nucleus of the new School of Mines, but the resolution lately issued by Government is silent on this matter. We hope this important recommendation has not been overlooked, and that Government may not disregard the advantage to be derived by engaging a staff, which has after the long intimate connection with mining education in this country, gained a knowledge of and experience in teaching mining most suitable to the conditions of the industry.

My predecessors have referred on more than one occasion to the wasteful methods adopted in working the coal mines in India, and while I do not wish to enlarge on what has been already written on this subject, I fully agree with the views expressed by them. This waste of the country's mineral resources was first brought to public notice by a member of this Institute, and, as you are aware, this led Government to take action with a view to preventing its continuance. Mr. Treharne Rees was brought from home to inspect the mines, investigate the conditions and to submit a report. Admittedly the time at his disposal was much too short for a work of this magnitude, and a closer investigation than he could possibly have made was necessary.

Mr. Rees in his report deals very comprehensively with the faults and failures, but I doubt whether he could have verified all his statements from personal observation in the time at his disposal. The suggestions made by him with reference to the remedies to be applied, appear to be wanting in detail as to their application, and the cause to which the unsatisfactory state of affairs disclosed by his report might be attributed, is only lightly touched on. As this seems to me to be the crucial point of the whole ques-

tion, I hope to be able to show that the remedy is only to be found by altering the condition of things that bring it about.

The Government of India appointed a Committee, of which the Hon'ble Mr. B. Foley, I.C.S., Commissioner of Chota Nagpur was Chairman, to consider this report, collect evidence from men intimately connected with the working of collieries, and finally to put their recommendations before them. This report was published about six months ago. The Committee consisted of eight members, seven of whom signed the recommendation conveyed in the report. One dissenting member submitted a minority report: these recommendations are now under the consideration of Government. The recommendations embodied in the majority report involve principles which would not be accepted in any other private industry. One can hardly imagine a jute-mill owner accepting legislation, whereby his mill should be managed by a Government Department, which has no financial interest whatever in it. It is to be hoped that, as the question is one of such great importance, no hasty decision may be come to.

It may be generally admitted that the present system of working coal should not be permitted to continue. Government has a rightful grievance, against the way the mines have hitherto been and are at present being worked, and against the loss of valuable minerals which the system has involved. It is regrettable that measures have not been taken by the owners themselves to rectify these errors, and still more regrettable that Government should require to introduce legislation to enforce an improvement. The report recommends that a Controlling Authority be set up, with powers to enforce the methods to be adopted in working and the means to be applied in carry-

ing them out. This may have a very far-reaching effect on the mining industry of this country. Such interference by Government in a private industrial enterprise is to be deprecated, and a reasonable and fair opportunity should first be given to those in whose hands the control presently rests, to put their house in order. On this point I think we must be in agreement with the dissenting member of the Committee of enquiry. Legislation is certainly necessary to deal with those factors adversely influencing the economical working of coal, over which colliery owners have no control, but I am of opinion this is as far as it is justified to go at present.

The minority Report which is concise and well considered, and which in my opinion completely sums up the situation, makes three recommendations to Government, and it might be permissible for me to read these recommendations to you, for the benefit of those who may not have already obtained a copy of the report. These recommendations are :—

- (i) that adequate transport facilities must be provided for the coal trade, that until this is done it is unfair to expect mining methods to be much improved, and that when the facilities are equal to the demand, there will be no need for Government interference;
- (ii) that all colliery owners should be compelled under the Mines Act to give a barrier of 50 feet of solid coal on the boundaries of their mines; and
- (iii) That Government should acquire the sand in the coal-field rivers and allow it to be taken free of charge by any Colliery Company wishing to sand-stow, and that the best and most

easily-worked reaches of the rivers should be reserved for groups of Colliery Companies prepared to work on a co-operative system.

The first recommendation deals with transport facilities. The author of these recommendations has had an unique opportunity of studying this question, and no one is better qualified to estimate the disadvantage the industry has suffered from this cause. When we review the history of the mining industry of this country over the past twenty years, we can hardly point to a time when adequate transport facilities have been provided, and since the outbreak of war, it has been steadily growing worse. The Government are not without their responsibilities for the starvation diet on which the Mining industry has been fed, and to which, may be attributed the main cause of the present unsatisfactory situation. Advantage has been taken by the Coal Department of the Railway Board of the constantly inadequate transport facilities, to rob the industry of its legitimate revenue and trading profits. The situation at one time became so serious that the only alternative to securing a Government contract was curtailment of output. This resulted in Companies' having to choose, between reduced profits or dead loss. In addition to this unfair advantage, derived from the wagon shortage, the system of purchasing all Government coal through one individual (though itself perhaps sound and proper) gives a great advantage to the buyer in creating unequal conditions between buyers and sellers. The counter-action to this system would have been a combination amongst the sellers, and it appears to be the only means whereby the mines can be assured of their legitimate revenue. So long as the transport facilities of the mining indus-

try remain in its present state, Gentlemen, this, I consider, is the principal cause of the unfortunate condition of the industry we represent. We should be assured of a reasonable return on the capital invested, which will not only give a fair margin of profit, but permit of a fund being set aside, adequate to meet the expenditure necessary to develop properly the mines, maintain and replace the plant and machinery when required, and permit of new methods of working being adopted when considered necessary. The margin between raising-cost and selling-rate has always been much too narrow and does not permit of any increase in pit-head costs without seriously embarrassing the financial position of the companies. Several of the older companies, by virtue of their favourable situation as compared with newer concerns, have, in spite of the adverse conditions already referred to, continued to make large and steady profits. For these companies I offer no excuse for permitting the wasteful methods of working complained of. Such methods wherever indulged in under these conditions, could only have been from a desire for greater personal gain, and it is here wherein the future danger may lie. It is therefore desirable, in order to guard against this contingency, that such rules be framed with definite responsibilities, that will ensure the mineral resources of the country being no further exploited in this fashion.

Government have already introduced legislation controlling the working of mines, so far as it affects the safety of the workers, and Mine Managers and Agents have been saddled with the responsibilities attached to it, and any failure on their part to fulfil these obligations renders them liable to criminal prosecution. It is difficult to see why legislation, covering the conservation of minerals

in the mine cannot be controlled by the same means. It is not a responsibility that can be placed on the Manager or Agent, whose duty it is merely to advise, but it is one that can rightly and properly be placed on the companies' Directors. It may be urged that Directors of coal companies in this country are not generally acquainted with mining problems, and that it may be an injustice to ask them to accept this responsibility. While admitting this view, I think they must agree, that it is their duty to qualify themselves, or admit to their Boards a qualified Mining Engineer, who will guide them in these matters.

The Directors of a company, appointed by the shareholders, are entrusted with the assets of that company, and the principal asset of a colliery company is the coal contained in its mines. They are therefore under an obligation to their share-holders and at the same time are under a similar obligation to Government, and it is incumbent on them to see that this valuable asset is not destroyed. I ask, in view of recent investigations.—Has this obligation been fulfilled? While in agreement with the minority report recommendation with reference to improved transport facilities, as the means to supply the necessary funds for the improvement so badly needed, it may be conceded it is also necessary that some authority should be established to see that such improvements are carried out. A new official staff as recommended in the majority report seems unnecessary. The existing Mines Department with an additional staff can quite well be entrusted with this duty. A Board of arbitration however to which disputes may be referred will be necessary, and the constitution of this board should be such that the professional and financial interests of the indus-

try should be represented. By this means I think the conservation of the minerals might be accomplished.

Sand-packing which seems to be the solution of the problem of working the thick seams found in this country has already been introduced at several mines, but the mines in which it has been adopted are favourably situated, being near a sand supply. This is a step in the right direction and it shews that the companies who have adopted this method now realise that for a given output the life of their colliery is in direct proportion to the amount of coal produced by it. I am confident that, given the facilities to obtain the sand and the necessary transport to collieries not so favourably situated, sand-packing will be introduced without any pressure from Government.

We may assume that Government will at any rate secure the sand supplies and it ought to be provided for the mines free of cost at the rivers. The problem that seems to require solution is the transport to the various collieries. In this respect I think we might utilise colliery sidings connecting them to sand-loading centres. This is a subject however that requires the study of both the railway and mining engineer and I feel sure it is one that their combined efforts would overcome.

Railway transport has always played an important part in industrial development; it has been rightly termed the nerve and muscle while coal is the stimulating power behind it, without which the nerve and muscle cannot fulfil their proper function. It should be the policy of the Railways therefore, in their own interests not only to supply the present requirements of the mining industry but to provide for the future. There are large areas of coal lands still undeveloped requiring only railway facilities to make them productive. Recent in-

vestigations in the Karanpura field have proved the presence of mineral wealth probably beyond the most sanguine hope. Seams of excellent quality with coking properties have been prospected and only await the means of putting them in the hands of the consumer.

New industries have sprung up all around us. Large iron ore deposits probably unequalled in any other part of the world in magnitude and quality are now being opened up, and they must be assured of an adequate and regular supply of the necessary fuel. Surveys are at present being made in this new field, and I am hopeful that in the near future a very large development on modern lines in the mining industry will be the result.

Large sums are involved in the construction of these new railways and it is for Government in whose hands it is to provide the funds to ensure that industrial development and enterprise is not stifled for want of them. This country has a great future before it. Nature has gifted it most generously with mineral wealth but it requires capital to develop it, and to attract capital, whether Indian or British, it must be assured of industrial and political stability. It is the first duty of Government to see that this is assured so far as it lies in their power and I appeal to all men, whether Indian or European, who have at heart the interests and welfare of this great country and the millions of souls it contains, to work together to this end. India has the seeds of prosperity in her but these can only be cultivated by peace and good will. With these assured I can foresee a much brighter future for the industry we represent.

Mr. F. L. G. Simpson said he had been asked to propose a vote of thanks to Mr. Miller for his presidential address and he did so with the greatest pleasure. He was of opinion that it was incumbent upon the members to increase the number. The Transactions of this Institute, in common with the Transactions of most scientific societies, went out to the world and were the voice of the mining community. The presidential address of Mr. Miller was the fifteenth. It was not a mere trite expression of opinion, but was the voice of the whole mining Institute. It had always been the aim of the Institute that the presidential address, as well as the contributed papers, should be full of good matter, and he thought they would agree that Mr. Miller's address had been no exception to the rule and that it was full of message to the mining world. He therefore had the greatest pleasure in proposing a hearty vote of thanks to Mr. Miller for his most interesting and useful address.

Mr. N. N. Mukerjee seconded.

Mr. Banerjee, supporting, said no efforts would be spared on the part of the Indian section of the Institute to induce their friends to join, not only to increase the income but also the knowledge. Some Indian members were too nervous to send in papers to be read. He hoped that in future they would take confidence and read papers. The resolution was cordially carried.

Mr. Heaton suggested that perhaps Indian members would be more willing to submit papers if British members would consent to read them. Reading the papers in English was probably the difficulty and if members came forward to help Indian members to get over this difficulty of expression they would probably find Indians more ready to contribute.

The President said the Institute should remove every possible obstacle in the way of Indian members who wanted to read papers. _____

Mr. R. R. Simpson then read a paper on "Accidents in Indian Mines and Mining Legislation."

Accidents in Indian Mines, and Mining Legislation.

BY

R. R. Simpson.

(With one Plate.)

In the charter of the North of England Institute of Mining and Mechanical Engineers, a society founded in 1852, and the parent of all similar societies, the objects of the Institute are stated to be "The prevention of accidents in mines and the advancement of the sciences of mining and engineering generally." In our own charter no mention is made of a desire to prevent accidents. It may be that the founders did not think that any great improvement was possible, as the low rate of accident in Indian mines at that time compared favourably with the rates in other mining countries. I take it, however, that one of our real, if not expressed, objects is the prevention of accidents, and that a paper on the subject may lead to a profitable discussion.

No paper dealing with accidents in Indian mines has ever been contributed by a member of the Institute for reading at our meetings. Perhaps the dullness of a subject so largely statistical is the reason for its neglect, and I shall probably be well advised to avoid the unnecessary use of figures. It may be explained that the paper deals only with mines to which the Indian Mines Act applies.

It is not so many years since mining engineers in India could contemplate with satisfaction the low death rate from accidents in Indian mines. Since I first came to the country, however, the rate has doubled, and during the last three years a pronounced increase has been maintained. In the upper diagram on Plate I a graphic comparison is shown between the death rates at all Indian mines and at all coal mines in Great Britain since the year 1897. The British rate is seen to have been practically constant throughout the period, except for the abnormal figures in 1910 and 1913, when disastrous explosions increased the rates. The Indian rate, on the other hand, despite a downward tendency between 1910 and 1917, has increased until it is now very little below the British rate. If the comparison be based on output the position of India is greatly inferior. In 1919 the death rate per million tons of coal raised in India was 11.95, as compared with 5.08 in Great Britain for the decennial period ending in 1917.

In the left hand diagram on Plate I the rates for Indian coal mines from 1906 are shown graphically. As might be expected the rates for all Indian coal mines and for coal mines in Bengal and Bihar and Orissa, where 96 per cent of the coal is obtained, closely approximate. The figures in 1908, 1910-11, 1913 and 1916 were abnormal due to the occurrence of severe explosions. During the period the death rate increased by 50 per cent and, except for the years 1910-11 and 1913, the rate in 1919 was the highest yet recorded, in spite of the fact that only one accident (14 killed) of any magnitude took place during the year. By far the largest death rate in Indian mines is that of Assam coal mines. The curve for Assam in the

diagram displays some remarkable peaks. That in 1910 is explained by the occurrence of a disastrous explosion, but those in 1915 and 1917 were due to increase of ordinary accidents. The rate in 1919 was three and a half times greater than that in coal mines in the large coal-fields. Perhaps the comparatively small number of persons employed accounts for the great variation from year to year. Similar great variation is shown in the figures for Baluchistan coal mines where the numbers are still smaller.

The right hand diagram in Plate I illustrates graphically the death rates at mines in India other than coal mines. For all non-coal mines the death rate has increased about one quarter since 1906. The peak in the curve in 1909 was due to activity in gold mining developments in Dharwar. That in 1914 was due to a general increase of accidents to which wolfram mining in Burma chiefly contributed. This latter industry first attained prominence in 1911. In 1912 its accident rate was nearly ten times greater than that in other non-coal mines. In 1919, however, it was no more than $2\frac{1}{4}$ times greater. The curve for manganese mines shows considerable variation. The peak in 1910 is accounted for by a collapse of side in a quarry which killed 11 persons. In 1917 the accident rate had come down almost to *nil*, but now it is at a higher level than in any year except 1910. By far the lowest accident rate for any mineral of importance mined in India is that for mica mining. The rate is only half that of other non-coal mines, and only about one-third of that for all mines in India.

The records of the Department of Mines in India date from 1894, when Mr. James Grundy, H. M. Inspector of Mines in Great Britain, was instructed by the Govern-

ment of India to enquire into the conditions at Indian mines. A brief mention of some of

Early records of
Indian mining conditions.

the details recorded in Mr. Grundy's
first report will be of interest:—

Of 62 mines visited only 36 mines had plans; only seven collieries had attempted to extract pillars, only three used explosives in coal getting, and only nine had erected air stoppings; coal fires for cooking or warmth were frequently to be found burning in underground galleries in collieries; at one mine a chain was in use for winding; and at another the winding engines had strap gearing; gins or whims were commonly used for winding; an explosion of gas at Dishargarh colliery caused the death of one European and five Indians.

An accident which occurred in 1897 at one of the
Kolar gold mines in Mysore holds
Notable Indian mining
accidents. the record for the number of lives
lost in an Indian mine. It happened

on a pay-day when the miners were attempting to leave work a little earlier than usual. The watchmen at the top of a ladder shaft closed the door at the top of the shaft to prevent exit. A large number of men were crowded on the ladders in the shaft, and a panic ensued, during which at least a hundred men fell from the ladders. Many were crushed to death and their bodies choked the air passage. The total death roll was 52.

In 1899 an accident at the Khost coal mines in Baluchistan caused a loss of 47 lives. A slight explosion of gas took place and shortly after the mine was found to be on fire. At the same collieries in 1908 an explosion initiated by gas and propagated by coal dust, caused 20 deaths

In 1912 twenty-three persons were drowned by an

irruption of surface water at a coal mine in the Jharia Coal-field, and in the following year two similar irruptions in the same coal-field, and one in the Raniganj coal-field accounted for 27 deaths.

In 1913 the most violent explosion on record in Indian mining annals occurred in the Raniganj Coal-field. It was initiated by a slight explosion of gas which set fire to brattice-cloth. The whole mine was speedily involved, and 27 persons lost their lives. There was several successive violent explosions, the detonations of which were distinctly heard at a place 19 miles distant.

In 1916 a collapse of the surface at a colliery in the Jharia Coal-field caused the loss of 24 lives.

The following is an abridged classification of accidents which have occurred during the last five years in mines under the Indian Mines Act :—

Cause.	PERIOD.						Percentage.
	1915.	1916.	1917.	1918.	1919.	1915-19.	
Explosions and suffocation ..	1	14	4	12	1	32	2.79
Falls of roof and side ..	93	81	111	126	170	581	50.52
In shafts ..	17	29	16	21	47	130	11.30
Explosives ..	7	4	9	9	7	36	3.13
Irruptions of water, etc. ..	3	3	4	6	1	17	1.48
Haulage ..	17	12	20	22	41	112	9.74
Miscellaneous underground ..	13	7	15	16	12	63	5.48
Surface ..	37	56	22	31	33	179	15.56
TOTAL ..	188	206	201	243	312	1150	100.00

The chief points of interest in this table are the increases in the proportion of accidents due to falls of roof and side, in shafts and by haulage. The percentage (50·52) of accidents by falls of roof and side agrees very closely with the British percentage for the period from 1903 to 1912, which was 50·69 per cent.

Responsibility for these accidents, as gauged by the Inspectors of Mines, over the same quinquennial period from 1915 to 1919 was as detailed below:—

Misadventure	..	..	49·73 per cent.
Fault of deceased	..	..	30·78 per cent.
Fault of fellow workman	..	..	6·07 per cent.
Fault of subordinate official	..	..	3·94 per cent.
Fault of management	..	..	9·48 per cent.
			100·00 per cent.

Three figures show that fully one half of the accidents might have been prevented, and there can be little doubt that this is generally true.

Considering the fact that in only a relatively small number of Indian mines is explosive gas emitted the fatalities due to explosions of gas are more numerous than might be expected. Neglecting minor fatalities from this cause there have been in the last twenty years eight major explosions causing the loss of 157 lives. In two of these cases the causes were slight ignitions of gas, but the main explosive effect in both was due to coal dust which carried the explosion to all parts of the mines concerned. The fact that certain Indian coal dusts are explosive is alarming, as many of the mines are both dry and dusty, and there are numerous cases where large areas of workings are interconnected. An explosion in an individual colliery might

involve as many as six other interconnected collieries. That this danger is by no means remote is shown by the example of Courrieres Colliery in France where, in 1906, a blown out shot initiated a coal dust explosion which involved three other interconnected collieries, and caused the loss 1,100 lives. This is the greatest single disaster in the mining annals of the world. Open lights were chiefly in use at the mines.

In two of the eight explosions mentioned above the gases which exploded were generated by mine fires, and the explosions occurred whilst the fires were being sealed off. Underground fires due to spontaneous combustion are of such common occurrence in the Indian coal-fields that it is fortunate that accidents have not been more numerous.

Although, I believe, there is only one recorded case of an explosion of gas in India caused by shot firing, yet, in view of the increasing use of explosives in coal mines, it would be advisable in gassy mines to use only " Permitted Explosives " on the British Home office list.

The prevention of explosions in mines can best be effected by improved ventilation methods and the use of safety-lamps only in mines where gas is likely to be found. The most gassy coal seams in India are the Dishargarh and Sanctoria seams, and at all collieries where these seams are being worked safety-lamps are now used or are about to be introduced. It may be hoped that the general introduction of methods of working coal by means of hydraulic packing will prevent outbreaks of fire and be the means of preventing loss of life from this cause.

As is the case in all mining countries the bulk of mine accidents in India are due to falls of roof and side. Owing to the fact

Falls of roof and side.

that working place in Indian mines are frequently crowded with numerous workers the numbers injured in individual accidents of this kind are often greater than in mines in Europe and America. Up till recent years the strength of the roofs of Indian coal mines has enabled the mines to be worked in comparative safety, but a rapid change is being brought about by the increase of pillar extraction in thick seams. The robbing of pillars is a fruitful source of accident, particularly where discipline is lax and supervision ineffective. More might be done to check the practice by closer supervision, more substantial fencing of disused workings and the prosecution of offenders. It is rarely that a prosecution is instituted except after an accident. A common departmental punishment for the offence is to withhold payment for robbed coal. The imposition of so inadequate a punishment is an encouragement of offenders. In certain Indian coal mines workers are paid by the length of gallery driven instead of by the weight of coal mined. There is thus no temptation to drive galleries of extreme width or to rob pillars.

The larger accidents by falls of roof and side have been due to three main causes:—

- (a) Failure to give sufficient slope to overburden in quarries.
- (b) The swaying over of props set under masses of roof coal without arrangement to prevent lateral movement.
- (c) Carrying an excessive area of roof on timber in pillar extracting operations.

Accidents of these classes are preventible and require nothing more than the application of knowledge and common sense for their avoidance.

Systematic timbering, first introduced at the French

collieries at Courrieres more than 20 years ago, brought about almost complete immunity from accidents by falls of roof at those collieries, although the strata are weak. For many years now collieries in Baluchistan and the Punjab have applied the system with great success. It was first introduced by mining engineers of the North Western Railway Company. The collieries in the Punjab which were formerly worked by the Railway Company have since 1911 been worked by Indian owners who have appreciated the benefits of systematic timbering and continued the system with success. All other Indian mineowners in the Punjab have followed suit. That the system can be applied with advantage in the larger coal-fields has been proved in many instances. In 1917, at a colliery where pillars were being extracted from a seam 11 feet thick, timbering rules were introduced as follows :—

- (1) Before the extraction of any pillar, the gallery from which the pillar starts is to have at least two rows of props set in it. If the gallery is wide enough, further rows must be set, so that the distance between each prop does not exceed 3 feet in any direction. Thereafter, this distance (3 feet) is to be observed throughout the pillaring, as the greatest distance at which props are to be spaced. The distance can be made less, if considered necessary, but in no case must it be exceeded.
- (2) At no time is the distance from the last row of props to the face to exceed 8 feet. The face for this purpose is the part furthest in, that is to say, if the lower part of the seam has

been cut away and there is 5 feet of overhanging coal, the last row of props will be 3 feet from the edge of the overhanging coal.

- (3) A row of props is to be set close to the back pillar to prevent any cutting of the back side of the next pillar.
- (4) Before a pillar is drawn off, at least one row of props is to be set in the gallery above that pillar from which the next pillar is to be started.
- (5) When a gallery has been standing wide for any time, special care should be taken in starting a pillar therefrom.

The risk of accident by balls of side in shafts has increased *pari passu* with the increase in the weight of the explosive charges used in sinking deep modern shafts. The effect of the explosion of such heavy charges is to shatter the walls of the shaft to such an extent that there is great danger to sinkers from the breaking off of small pieces of rock. At one large group of collieries the danger is avoided by placing no shot holes near the walls of the shaft, and hand dressing the walls with the pick. Where this has not been done it is advisable to line deep shafts throughout, as is the rule rather than the exception in Great Britain.

Accidents in shafts at Indian mines have increased of late. They caused the loss of no less than 47 lives in 1919. Most of the accidents could be avoided by:—

- (a) Careful selection of ropes, chains and all materials used for lowering and raising persons;
- (b) Thorough daily examination of the same by competent persons;

- (c) Periodical annealing of chains, etc.;
- (d) The use of safety gates on cages;
- (e) The provision of convenient protected roads round the edges of shaft bottoms instead of or in addition to the usual pass-byes.

Most of the accidents due to asphyxiation could be avoided by the simple precaution of lowering a light to test the condition of the air before descending a disused shaft. A word of warning may be given with reference to the use of acetylene lamps. Such lamps are now commonly used by all superior officials in Indian collieries, and the powerful light which they provide is of the greatest service in detecting weaknesses in roofs and sides. They will, however, continue to burn in an atmosphere which will not support life. On one occasion this quality of the acetylene lamp nearly cost the lives of myself and a party of explorers.

Considering the low intelligence of many of the persons who handle explosives in India the number of accidents arising from their use is not large. Improper treatment of missfired shots is the chief source of accident. Strict enforcement of the rules for procedure in such cases can reduce this risk to a minimum. The misuse of country gunpowder in the coal-fields has caused a regrettable number of fatalities. It has been the practice to issue loose gunpowder to miners on the surface, and to take no further interest in the explosive until it comes to be used underground. The result has been that powder has been kept in dwelling houses and made up into cartridges anywhere, often in the vicinity of domestic fires. In damp weather the powder has been spread in the sun to dry or dried on the tops of boilers or other unsuitable places. That accidents, some-

times involving the death of innocent children, have occurred is not surprising. I commend to the notice of users of gunpowder a code of rules for the handling and custody of powder which was introduced in 1919, by the Agent of a large group of collieries.

RULES FOR THE USE OF COUNTRY GUNPOWDER.

1. In the future no powder shall be issued to miners except in the form of cartridges ready for use.
2. The powder is to be obtained from a manufacturer on the colliery, and it must be issued by him in the form of cartridges.
3. A proper place shall be set apart for the packing of powder into cartridges, and a competent person shall be employed for the purpose of cartridge making.
4. All workmen and shot firers who have cartridges issued to them shall be directed to return any unused cartridges either to the manufacturer or magazine.
5. In the event of cartridges being rendered faulty by moisture or otherwise, workmen and shot firers should not be permitted to reconstruct the cartridges. This must be done by the manufacturer or the man in charge of the special room used for the purpose of cartridge making.

The chief source of accidents by irruptions of water in Indian mines is heavy rainfall causing the flooding of streams and rivers and the bursting of embankments. When such takes place the entrances of mines may be submerged or

the weight of flood water may break down the surface overlying mine workings. In either case the workings are speedily inundated, sometimes with loss of life. Accidents of this type can be avoided by :—

1. Refraining from the extension of workings under areas where the cover is weak and insufficient.
2. Siting mine entrances on high ground above flood level.
3. Providing artificial protection such as walls or embankments of sufficient strength.
4. Interfering as little as possible with natural surface drainage, and, where it is necessary so to do, providing culverts of ample dimensions.
5. Withdrawal of workpeople at times of abnormal rainfall from workings where there is any possibility of inundation.

At a coal mine in the Central Provinces situated near a river in which flood water has been known to rise to a height of 50 feet vertically, the collars of the shafts have been protected by walling. As it is important to avoid fracture of the strata and subsidence of the surface, the pillars are extracted on a system by which the excavations are filled by hydraulic packing.

Accidents due to unintentional connection with the workings of waterlogged mines have not been numerous in India. Their avoidance calls for strict accuracy in surveying and the careful observance of the rules laid down for procedure when workings are approaching old waterlogged workings.

Up till 1918 there was a gradual reduction of the percentage of accidents due to haulage, and the improvement was

Haulage.

most marked in the years following the introduction of the Special Rule applying to coal mines which requires the provision of a second appliance to prevent runaways from the tops of haulage slopes. In 1919, however, the number of haulage fatalities was 41, or nearly double the number in the previous year. Many of those killed were hookmen who accompanied trams in motion. Run-riding on trains proceeding at a speed higher than three miles per hour is prohibited in Great Britain, and a similar prohibition for Indian mines is probably advisable. The majority of those killed were, however, persons not employed in haulage operations. Many of these lives could have been saved if travelling roads separate from the haulage roads had been provided and their use enforced.

Accidents from the use of electricity in and about
Electricity. mines have not been numerous.

There were three fatalities in 1918, and the same number in 1919. As this form of power is extending so rapidly in Indian mines the comparative freedom from accident is a testimony to its safety. Modern electrical apparatus is largely fool proof, but that accidents can happen, even to persons fully acquainted with the danger, is shown by the fact that in 1913 a mine manager was electrocuted, and during the present year the Chief Engineer of a mine Power Station was electrocuted, and another person holding a similar position elsewhere severely burned. It may not be generally known that a shock from a circuit at 100 volts only has been known to cause death. The circumstances favourable to a fatal shock at a low pressure would seem to include the following: A moist state of the skin, a large area of contact, a considerable length of time during which the person remains in contact. All these conditions can be obtained

in mines, where persons wearing the minimum of clothing work in a moist atmosphere in isolated situations.

The most serious accidents occurring on the surface at mines have been those caused by Surface accidents. subsidence of the surface due to the collapse of mine workings. One such accident in 1916 caused the loss of 24 lives. They can be avoided only by prompt evacuation of the surface as soon as underground conditions favour collapse. Old workings underlying surface buildings should be periodically inspected and their condition noted. All surface buildings should be shown on the mine plans.

Perhaps the most common avoidable accidents are those by drowning in unfenced or insufficiently fenced boiler tanks. In the majority of cases the persons drowned have been young children. Such tanks should be walled to a height of not less than three feet above the ground, and the accumulation of ashes, etc., near the walling should not be allowed.

Hand-shunting of railway wagons is responsible for numerous fatalities all of which are clearly preventible. Hand-shunting should only be carried on under the direct supervision of a responsible male person, who should either himself control the brake or depute a competent person to do so. Children should not be allowed to assist, and pushing should only be done from behind. Only one wagon at a time should be moved.

About one half of the accidents in Indian mines are due to the fault of some person, usually the deceased. For any great improvement in this respect we must look to education. In the United States of America * at

* "Coal mining and the Coal miner," by H. F. Bulman.

certain collieries moving pictures are exhibited to the miners with the object of showing

Education as a means
for the prevention of ac-
cidents.

them exactly how the work should
be done with safety and efficiency.

This method of instruction might
be used with advantage in India.

“Some large colliery companies in the United States of America * have effected a marked improvement by appointing a man to do nothing else than to instruct and to stimulate their workmen in the best way of taking care of themselves. Much, no doubt, depends on getting the right man for the job. He should be perhaps a man of their own class to whom the miners will take kindly, and not a colliery official. He goes round amongst them when they are at work, pointing out to them matters that want attention and risks to be avoided, and periodically, say once a week, he holds a meeting at some centre convenient for the workmen, and addresses them on the subject.”

“Some companies have a safety Inspector whose services are devoted solely to safety work, and who is responsible to the management for the adoption and enforcement of safety measures.”

“Increased safety from accidents has also been achieved by a system of co-operation between colliery owners and Insurance companies. Mining engineers appointed by the Insurance companies inspect the collieries and fix the rates to be paid according to the relative safety conditions of the colliery. They call attention to points affecting safety which may have been overlooked and recommend measures that may be adopted, and by atten-

* “Coal mining and the Coal miner,” by H. F. Bulman.

tion to such points a considerable reduction in the premium to be paid may be effected."

The National Safety Council of Chicago counts amongst its members over 165 mining companies. It is carrying on in the United States of America a vigorous "Safety First" campaign. One form of its activities is the issue of striking posters showing the right and the wrong way to perform various mining operations with safety. A representation of some of these posters appeared as a supplement to the *Colliery Guardian* in the issue of January 16, 1920. This supplement has been pinned up on the blackboard for the convenience of members interested.

In a paper * read before the members of this Institute in 1907 the writers recommended
Rescue Stations. the establishment of Rescue Stations at suitable centres in the coal-fields. It was not proposed to instal breathing apparatus, but only appliances, tools and materials required when fighting fire, gas or water. The idea has never been developed, but most of such appliances, etc., are now available at the large colliery stores kept by the larger companies.

It is doubtful if the provision of breathing apparatus is advisable in India. The deterioration of rubber in hot countries is so rapid that it would be difficult to keep the apparatus in sound repair. According to the Report of a Royal Commission in 1909 no less than 14 persons in Great Britain had lost their lives owing to defects in breathing apparatus. It is to be feared that the use of such apparatus in India would be attended with greater risk than the benefits to be obtained would justify.

* "Fighting a Colliery fire," by Messrs. W. H. Pickering and R. R. Simpson, Trans. Mg. and G. Inst. of India, Vol. II, Part 2.

The mortality from injuries of a simple character in Indian mines is high. In numerous cases of severe haemorrhage the patient bleeds to death before skilled assistance arrives. The need for first aid training is great. It would be of advantage if mine officials were drilled regularly in "first aid" methods by the mine doctor. This is actually done at certain Indian mines. In 1911 the Bengal Coal-fields Ambulance Committee was formed, and for some time its activities were considerable, but the movement languished and nothing was done during the war years. Funds are, however, still available, and it is to be hoped that the Committee will soon resume its beneficent labours.

In many of the smaller mining fields of India, particularly those which are controlled from England, there are well equipped hospitals, both for Europeans and Indians, in charge of competent surgeons. In the larger coal-fields, however, there is a general lack of hospital accommodation and skilled surgeons. Many lives are lost and much needless suffering entailed by the absence of proper facilities for the treatment and care of injured and sick employees. A few firms have built small hospitals for Indians, and employ competent surgeons, but at the majority of mines the so-called "doctor" is an unqualified man with only the barest minimum of medical and surgical knowledge, the dispensary consists of a few drugs, etc., kept in the mine office, there is no place for operations or proper facilities for their performance, and patients have to be treated in their own houses. In cases of severe injury patients are carried in doolies a distance of from five to twenty miles to the small Government hospitals at the Civil Headquarters. As might be expected they are frequently dead or

moribund before arrival. There is no hospital accommodation for Europeans, and European patients have to be sent to Calcutta. The reason for this deplorable state of affairs is the same absence of co-operation between mine-owners which is responsible for the bad housing accommodation and lack of social amenities in the coal-fields. For some years the Indian Mining Association carried on a Medical Fund and maintained a qualified medical man in each of the two great coal-fields, but the Fund was wound up some time ago for lack of sufficient support. At present the only hope of improved facilities would appear to be action by the Mines Boards of Health. It is probable that mineowners and managers would welcome such action.

As much of our Indian mining legislation is founded on British practice it may be of interest to consider the progressive stages of mining legislation in Great Britain.

For much of the information below I have drawn upon a Presidential address* delivered by Mr. Isaac Meachem before the members of the South Staffordshire and East Worcestershire Institute of Mining Engineers in 1903.

The first Act of Parliament affecting mines was passed in 1736 when it was enacted that "if any person or persons shall wilfully and maliciously set on fire, or cause to be set on fire, any mine, pit or delph of coal, or cannel coal, every person so offending, being thereby lawfully convicted, shall be adjudged guilty of felony, and shall suffer death, as in cases of felony, without benefit of clergy." It is evident that our forefathers had very definite ideas as to the proper method of dealing with Bolshevism. As is, however, the lesson of history severe repression failed to attain its object,

* Transactions, Institution of Mining Engineers—XXVI, p. 301.

for in 1769 it became necessary to pass "The Malicious Injuries Act" in which offences are detailed at much greater length, but by which the penalty appears to have been seven years transportation.

One of the earliest recorded explosions occurred at Mostyn, North Wales, in 1675, and during the eighteenth century too numerous explosions in mines attracted public attention, until in 1800 an Act was passed "For the security of collieries and mines, and for the better regulation of colliers and miners." The first clause enacted that "anyone filling up an airway, or damaging any part of a mine or road-way leading to it, or digging mineral from any waste, is guilty of felony and is to be transported for seven years."

The next legislative enactment affecting mines was the "Truck Act" passed in 1817, by which the payment of mine labourers in goods was prohibited. In 1842 an Act was passed by which "no women or girls were to be employed underground, and no boys under the age of 10 years, ..., that wages were not to be paid at or near a public-house, that the Secretary of State should be empowered to appoint proper persons to visit and inspect the mines and collieries." In 1850 another Act was passed which provided for the appointment of inspectors and gave them authority. By it also fatal accidents were to be reported to the Secretary of State, and correct mining plans were to be kept and maintained.

In 1855 an amending Act was passed, and under it General Rules were made providing for ventilation, fencing and lining of shafts, signalling in shafts, indicators and brakes on winding engines, and safety appliances on steam boilers. In 1860 this Act was amended and renewed. The age of prohibition for boys was raised from 10 to 12 years,

persons in charge of winding engines were not to be under 18 years of age, and all serious non-fatal accidents were to be reported to the Inspectors of Mines. In South Staffordshire a code of 45 Special Rules was drawn up.

In 1862 an accident occurred at Hartley colliery by which 204 lives were lost. The mine was worked by a single shaft divided for ventilating purposes by a wooden partition. The pump-rods in the shaft broke, and the shaft became choked with debris. The ventilation was stopped and the whole of the men in the mine were suffocated. In consequence of this accident an Act was passed in the same year prohibiting the working of coal mines and ironstone mines without at least two means of exit.

In 1872 a consolidating and amending Coal Mines Act was passed, and rules for managers' certificates were made. Again in 1887, 1896 and 1911 further Acts came into force.

From 1851 to 1887 the fatal accident rate in coal mines was steadily reduced from 4.55 to 1.85 per 1,000, and in 1902 a further reduction to 1.23 per 1,000 had been effected.

Although Government inspection of mines in India commenced from 1894, there was no undue haste in the enactment of legislation affecting Indian mines. The first step was the appointment of a Committee in 1895 "to submit rules for the working of mines in India." The members of this Committee were Messrs. H. C. Williams, I.C.S., E. Cable, J. Grundy, Inspector of Mines, W. Miller and Kumar Dakhineswar Malia. The report of the Committee was signed by all the members, but the last mentioned gentleman submitted a note of dissent in which he expressed the opinion that there was no necessity for

mining regulations. The Committee drew up a draft Mines Act, and a code of General Rules, and laid down the principles which Special Rules should follow. The draft Act contained 37 sections and the draft General Rules were 137 in number and applied to mines of all kinds of mineral and quarries 10 feet deep. The proposals met with considerable opposition, and it was not until 1901 that the Indian Mines Act, 1901, became law.

In the same year a rule applying to all mines was made providing for the reporting of accidents; and in 1904 by another rule all mineowners were required to submit annual returns of labour and output.

It was not until 1904 that rules regulating the working of mines were introduced. In that year a code of twenty-six rules applying to coal mines only became law. Two years later, i.e. in 1906, a code of twenty-eight additional rules applying to coal mines only was made. They relate to coal mine managers' certificates, the conditions under which they are granted, and the qualifications which the managers of the various classes of coal mines must possess.

In 1907 three rules were added to the Act for the purpose of safeguarding railways. Under these rules notice must be given whenever it is intended to extend mine workings within 50 yards of a railway.

In 1905 a code of Special Rules for the control and guidance of persons employed in coal mines was drafted, but it was not until 1913 that the cumbersome procedure for the establishment of such rules was set in motion.

In 1911 rules regulating the working of manganese, mica and limestone mines were introduced, and in 1916 Special Rules for the control and guidance of persons employed in manganese mines in the Central Provinces were established.

The Indian Electricity Act was passed in 1910, and in 1911 rules regulating the use of electricity in mines became law.

In 1918 four additional rules applying to coal mines in Bengal and in Bihar and Orissa were made. These rules provide for the adequate acquaintance on the part of coal mine officials with the number of persons working in a mine at any given time, and for gates at the entrances to mines which can be entered on foot. In the same year rules for the regulation of tungsten and tin mines in the Tavoy District were made by the Government of Burma.

The Indian Mines Act has now been in force for nearly twenty years and although its deficiencies are numerous and apparent, it will probably be conceded that it has worked well and proved to be of benefit both to mine-owners and their employees. The rules for coal mines have received few additions since they became law in 1904 and 1906. Present day mining practice at the more important coal mines is in advance of the rules, and perhaps the time has now arrived for a further strengthening of the code to bring the laggards into line. A general wish has been expressed for rules requiring the certification of underground sirdars. Suggestions have been made for improvement of the rules relating to plans, inspections, raising and lowering persons, explosives, ventilation and fencings in coal mines.

With respect to mines other than coal mines there is need for rules regulating the working of gold, lead, silver and copper mines, whilst the code for manganese, mica and limestone mines might profitably be applied to mines of other minerals such as gems, slate, magnesite, bauxite, clay, iron, chromite and steatite.

The proceedings of the International Labour Con-

ference at Washington in 1919, and the recent inquiry by the Coal Committee may foreshadow legislation regulating the hours of mine labourers and for the conservation of coal, but these matters are still under the consideration of the Government of India. Both have a distinct bearing upon the subject of the prevention of accidents in mines.

Mr. Simpson was thanked for his valuable paper on the proposal of Mr. Oliver, seconded by Mr. Thomas.

Mr. E. J. Beer was not present to read a paper on "Additional Notes on the Geology of Guzerat" and this was accordingly taken as read, copies being distributed.

Additional Notes on the Geology of Guzerat.

BY

E. J. Beer, F.G.S.

(With one Plate.)

General.

In a map published in the *Transactions* of the Mining and Geological Institute of India, Vol. XIII, Part 2 (Notes on rocks from Pavagarh to Dohad), the line of contact between intrusive granite and crystalline Dharwars was left blank (for commercial reasons) approximately from Baria to Godhra. This contact line has points of interest, because the pegmatite dykes which break into the metamorphics from the granite are associated with small quartz veins carrying molybdenite and wolframite. In the present brief paper some additional notes on the geology and minerals of this country are recorded.

Blanford (*Mem. Geol. Sur. Ind.*, Vol. VI, p. 322) has already discussed the absence of trap for some 60 miles to the east of Pavagarh and the possibility of its former existence, whilst I have already made mention of the limestone to which the trap gives rise where it rests upon schists (*loc. cit.* p. 124). In addition to the outcrops of Lameta and Deccan Trap rocks shown on the map illustrating the paper referred to, the following deserve mention:—

Deccan Trap and
"Lameta."

At Wadela, near Chancelao station and some 25 miles

N.N.E. of Pavagarh, are a few cubic feet of "Lameta" limestone, a last relic close to the edge of the granite. Twenty miles N.N.W. of Pavagarh there is Deccan Trap N.N.W. in the Mahi river-bed; and again 37 miles to the in Balasinor State there is a large plateau of limestone resting upon granite, whilst some 50 miles distant, near Baad, there is a still considerable strip of trap. This brings us within 30 miles of Ahmedabad and the valley of the Sabarmati.

In view of the recent work of the Geological Survey of India showing that the so-called "Lameta" limestone of the Central Provinces is in many cases a replacement product due to solutions derived from the overlying Deccan Trap, and the confirmation of these results afforded by the region now under discussion, it is obvious that we may accept the outlying patches of this limestone marked on the map accompanying my earlier paper and the additional data just recorded as stray evidence in favour of the former extension of the Deccan Trap over the country round Pavagarh and to the eastwards thereof, thus bridging the break between Kachh and Central India.

Two of the places mentioned above, one in Balasinor State and one in Kaira, have some points of special interest.

The Balasinor country is granite, but close to the city a sheet of limestone, sometimes a few feet thick, but usually weathered away altogether and represented only by calcareous clay forms an elevated plateau above the town. It rests directly upon the granite, which outside the plateau forms tors, but is practically flat where the trap has rested upon it. As far as I am aware, no trace of trap now remains; but the Mahi river-bed at Sevalia bridge is of basalt. This is 10 miles south of the plateau.

The chief point of interest is the way the Trap-products seem to have caused the alteration of the upper portion of the granite, which has yielded a white clay or marl mottled with various bright colours—grey, purple, green, pink and orange. As with “Lameta” limestones, the upper part is very cherty, with opaline streaks. Lower down the clay is soft and spotted with green, the spots being incompletely altered granite. Lower still, remains of felspar crystals can be distinguished, and beneath that stratum the rock contains sharp quartz grains and is gritty. It then passes from a calcareous grit into a softened granite. The transition is well graduated, and a white “china-clay” of sorts may be collected by keeping above the grittiest and below the solidly calcareous portions. Exposure whitens the damp greenish and mottled layer considerably but as a clay or limestone it must always be impure and probably useless for serious economic purposes.

The other interesting place reminiscent of the Deccan Trap is Taiabpur, 16 miles distant. Here the trap appears to be completely absent, but it probably occurs below the various products to which it has given rise. These are, from above downwards, laterite, bauxite, and a most peculiar collection of clays of every colour, which after undergoing continual changes for 20 or 30 feet, begin to look suspiciously like mottled amygdaloidal trap. Some of the clays could be used for crayons, being soft and “greasy.”

On the top, the laterite passes by abruptly graded stages into various end-products. These are: bauxite, Kankar-limestone, white fire-clay, yellow and orange limonite, red ochre, and hæmatite. I have a set of specimens showing the actual formation of each of these miner-

als from clay (? amygdaloid) and through one another into laterite. The entire series of phenomena appears to be due to concretionary action.

Minerals of Economic Value.

There is an unusual and isolated occurrence of galena at Jafrabad near Godhra, where Galena. a slight ridge overgrown with teak trees owes its elevation to a hard vein of white quartz, with much greenish yellow epidote. The ridge, which is a furlong or so long, dies down under cotton fields to the north, beyond which it cannot be traced.

The vein is a few feet thick and is practically vertical. In addition to the epidote it carries a small quantity of altered biotite and some small hornblende needles, as well as strings and pockets of galena irregularly distributed.

Being in *inamdari* land (private ownership), would-be prospectors of the place are discouraged by the insecurity of their proposed tenure and the high fees which they would be forced to pay. Nevertheless a good deal of work has been done, in consequence of which no galena is now obtainable, even as a sample. The occurrence is mentioned by Phillips in his "Treatise on Ore Deposits," 1884; but the omission by this author of the actual name of the place gave the present writer much trouble in rediscovering the site, which was mentioned only under the name of a local tank outside the *inamdari*.

The prospecting work is obviously of more recent date than 1884, covers the whole length of the ridge and presumably proved too costly to be continued to a greater depth than about 6 feet.

The whitest, most plentiful, most constant and most

conspicuous form of quartz in this area is associated with the Dharwar quartzite of Nawanagar. It is used for glass-making locally, being burnt in a kiln and then crushed and mixed with felspar, calcite and soda.

Probably the quartzite itself would do equally well if it could be easily crushed, for it is free from the rusty surfaces that form the one impurity when the quartz is used. This iron is corrected by a little Shivrajpur manganese-ore so that all the glass constituents could be local ones, if soda from efflorescence and felspar from pegmatite were substituted for imported material.

In addition to the minerals enumerated in my former paper (*loc. cit.* pp. III-II2) as occurring in the quartz of the central zone, pyrite is also a type mineral, whilst two ores of tungsten are sometimes found in insignificant quantity. All the lenses or veins at present located have a high, almost vertical, dip, so that prospecting is costly and unremunerative.

In the afternoon members paid a visit to the Victoria Memorial.

Memoir of George Francis Adams, *C.B.E., M.Inst.C.E.*

George Francis Adams, who was born at Cardiff in 1870, was the son of the late George Frederick Adams, M.Inst.C.E., a member of the firm of Messrs. Forster Brown and Adams, now Messrs. Forster Brown and Rees, the well-known mining consultants.

He was educated at Elstree, Harrow and Bedford. He served apprenticeship to a mining engineer, and, after a short experience of mine management in South Wales, was in 1894 appointed an Assistant Inspector of Mines in Great Britain, and posted to the South Wales district. In 1902 he was appointed an Inspector of Mines in India, and in 1910 he was promoted to be Chief Inspector of Mines in India.

Mr. Adams was a member of the Institution of Mining Engineers, and of the Institute of Civil Engineers. He was one of the founders of the Mining and Geological Institute of India, and served it as President in 1912.

Mr. Adams was deeply interested in mining education in India, and was *ex officio* President of the Board of Examiners for coal mine managers' certificates, and of the Mining Education Advisory Board. In 1913, he served as a member of a Committee appointed by the Government of Bengal to consider the question of mining education in Bengal and Bihar and Orissa. The Committee recommended the establishment of an Imperial School of Mines at Dhanbad, E.I.R. In 1914 a sub-committee consisting of Mr. Adams and two other gentlemen, was deputed



to visit Schools of Mines in Great Britain with a view to investigating the subjects taught and the methods of teaching them. The sub-committee submitted a valuable report which was published in 1916. Owing to the outbreak of war the proposal to build a School of Mines had to be postponed, but in Resolution No. M-36, dated 11th September 1920, the Government of India have declared their intention to establish a School of Mines and Geology at Dhanbad at an early date.

In 1917, Mr. Adams served on a committee appointed by the Government of Bihar and Orissa to report on the housing of labourers in Bihar and Orissa. He was an official member of the Jharia Mines Board of Health, of the Asansol Mines Board of Health and of the Jharia Water Board, and took an important part in the discussions preliminary to the drafting of the Acts necessary for the carrying out of the objects for which the Boards were constituted.

During the war he was President of a Priority Committee which reported to the Indian Munitions Board on all indents for mining machinery required in India. His arduous labours on this behalf were fittingly recognized by his being made a Commander of the British Empire in 1919.

In 1920 he served as a member of the Coal-field's Committee appointed by the Government of India to consider the question of the waste in the methods of mining coal in India.

In 1904 he married Miss Margaret Elizabeth O'Connor, who, with one daughter, survives him.

Mr. Adams was recognized throughout India as a mining expert of great sagacity. His opinion carried much weight and was eagerly sought for on matters in

connection with the mining industry in India. He was an eloquent speaker and excelled not only in studied utterance, but also in impromptu speech, in which his ready wit and happy way of saying the right thing were remarkable. His urbanity of manner and unfailing tact had endeared him to all those with whom he came into contact, and his untimely death at the age of 50 has been widely deplored and has evoked numerous expressions of regret. At the Annual General meeting of the Institute on February 11th, 1921, in Calcutta a resolution of condolence with Mrs. Adams and her daughter was proposed by Mr. Glen George, and carried unanimously, everyone standing in silence.



Annual Dinner.

The Annual dinner of the Mining and Geological Institute of India was held at Peliti's Restaurant, Calcutta, on Friday, the 11th February 1921, at 8 p.m. Mr. George Miller, President, occupied the chair and the following members and guests were present:—

Messrs. D. A. Anderson, J. D. Balfour, R. Barrowman, J. Bullock, A. Cochrane, A. Craven, G. Crawford, A. Dods, S. Eustace, Glen George, W. M. Glover, W. H. Goldsworthy, J. G. Harding, B. Heaton, C. A. John Hendry, W. A. Hockley, J. H. Lang, C. P. Lawson, E. D. McDermott, D. B. Meek, J. Miller, W. D. Panton, J. R. Phillips, E. H. Robertson, W. Saunders, F. L. G. Simpson, R. R. Simpson, H. M. Tarlton, J. Thomas, G. C. Webster, J. B. Wardlaw, H. Webber, W. Webbre, J. C. Wright, and G. A. Young.

The guests of the Institute were.—

Sir Robert Highet, Kt., The Hon'ble Maharajadhiraj Bahadur of Burdwan, The Hon'ble Mr. P. C. Mitter, C.I.E., Messrs. S. C. Stuart-Williams, W. S. J. Willson, J. Coates and J. H. Pattinson.

The toast of the King Emperor was proposed by the President, and drunk with enthusiasm.

Mr. Glen George, submitting "The Government of Bengal" said:—

Mr. President and Gentlemen.—I rise with pleasure to propose the toast of the Government of Bengal coupled with the names of Sir Henry Wheeler and the Maharajadhiraj of Burdwan. These are, I am afraid, evil days for Governments all over the globe, as the former tendency of all citizens loyal and otherwise to blame their governments for everything wrong,—from the weather to blue-bottles in the meat—is nowadays intensified tenfold, and

all people are blaming their governments for the parlous state into which they have fallen, forgetting that, while justified in a few cases, in most the blame is unfairly given, as their troubles are due to world-wide conditions; this is particularly the case in India.

Still, to-day it is a lucky government that gets anything good said of it, and I am sure the Government of Bengal, deserving of general praise as it doubtless is, will welcome the fact that the Mining Industry has nothing but good to say, and thanks to render. The chief cause for the gratitude of the industry is that the Government of Bengal has, in regard to mining, confined its efforts to assistance, and has in no way endeavoured to control it by over-regulation. In doing so, it has paid the mining community a compliment which it sincerely appreciates. The Government has confined its activities to interest and exertion in the administration of the Mines Act, in Mining Education and in a particularly beneficent way in the Mining Settlements Act which is proving so great a boon to the coal-fields. That it will have to interfere considerably more in the future is probable.

The increasing demands of labour both as regards pay and hours may possibly necessitate Government regulation and the question of waste in mines and more stringent regulations under the Mines Act will most certainly do so. I am sure, when such regulations come, they will be met by the Mining community in the most reasonable spirit, recognising the good wishes and intentions of the Government as they have in the past.

The war has modified the attitude of the strongest individualist and we all realise the necessity of any one industry in a section of the community recognising its duties to the State, and I am confident the Government

of Bengal will find the mining industry recognising its duties.

I beg you gentlemen to drink the health of the beneficent Government under which we live.

The Hon. Mr. P. C. Mitter replying said :—

Mr. President and Gentlemen.—When your Honorary Secretary very kindly invited me to dine with you this evening I accepted his invitation with pleasure, for I thought it would give me an opportunity to listen to many interesting speeches and also to enjoy a good dinner. I did not realise at the time that your Honorary Secretary intended later on to make me one of the victims. When he approached me again with the request that I should respond to the toast of the Government of Bengal, I however, thought I could not very well say ‘No’ to his request after having accepted the dinner, but, Sir, I have all along wondered and I still wonder why he has selected me amongst the seven gentlemen who are the colleagues of my Chief Lord Ronaldshay. I confess I speculated on the reason. I thought that perhaps it was realised by the Honorary Secretary that the members in charge of the Reserved Departments were too wary to be easily caught and so he ruled them out. I thought the senior member in charge of the Transferred Departments has so often proclaimed that he believes in going to bed early that he also was ruled out, but I have not been able to arrive at any reason as to why the junior member who is in charge of industrial education has been ruled out too. I thought also perhaps your Honorary Secretary intended to have one of the members in charge of the Transferred Departments and he spotted me as the softest and the most pliable of the three. However, it is idle to speculate and here I am to respond to the toast of the Government of

Bengal which Mr. Glen George has proposed so heartily. I only wish that the task were entrusted to a worthier person. Allow me to thank you heartily.

Realising, Sir, that I am here as one of the members of the Transferred Departments, I feel I ought to confine my remarks mostly to the view-point of the members of that Department. Under the interesting, if somewhat novel, constitution promulgated by the Government of India Act, 1919, we the Ministers are responsible to the Council and through the Council to the people.

Our colleagues in the Government are responsible to the Secretary of State and through the Secretary of State to the British Parliament. So far as I am aware dyarchy was never tried in any modern state and the future alone can show whether dyarchy will be a success or a failure, but during the short time that I and my colleagues of the Transferred Departments have been members of the Government, we have found it possible to maintain the most cordial relations between the two halves of the Government and at the same time to discharge our responsibilities to our respective authorities.

Gentlemen, you are naturally very much interested in the question of development of the mineral resources of the country. Your Institute, I understand, is designed to study all branches of mining methods and of mineral occurrences in India with a view to disseminating information for facilitating the economic development of mineral resources in the country. You have also British and Indians as members of your institute. It may, therefore, interest you to know what my views are on the question of Indo-British co-operation in the development of Indian resources generally. Many of you may not know that in April last year I published a short brochure, which was

widely noticed in the newspapers, in which I examined the question from the narrow point of view of mere material self-interest of the two races, and ignoring for the purposes of such examination the many higher and nobler reasons that exist for such co-operation, and I then deliberately came to the conclusion that even from the narrow material point of view the interests of the two races were identical, provided they agreed to be just to each other and provided the Britisher and the Indian acted with mutual toleration. I also laid down that it was necessary for the Indian to realise that, although his patriotic devotion must undoubtedly be to India first, such must fit in with the aim of self-government within the Empire and must therefore embrace a wider patriotism, namely, a patriotism for the British Empire as a whole. From that point of view Indian patriotism must value and promote good-will towards England, the head of the Empire, and must also try to abjure in future so far as possible bitterness between the races. At the same time it was necessary to remember that in case of any conflict of interest (which in my view ought not to arise if both the races proceed on right lines) the Indian must stand out for his motherland. So far as the British in this country were concerned—and I am referring to those who have for practical purposes made India their second home for the better parts of their lives and whom I hope I may be permitted to describe, if not at the present moment, in the near future as Indians by adoption—I suggested that their patriotic devotion must undoubtedly be to Great Britain first but they must remember that for the time being they are Indian citizens and that India is a part of the British Empire and as such India has every right to claim their devotion as well and to pursue a constructive

policy that would attract patriotic Indians who desire to make India great as a component part of the British Empire. If any conflict of interest arise between Great Britain and India they must naturally stand out for their motherland, Great Britain, but, as I have already said, if both races proceed on right lines no conflict of interests need arise.

If the British and the Indians proceed on right lines, we ought not to find any difficulty in adjusting our respective self-interests. I believe that India at the present moment is at the same time a rich and a poor country. It is rich in its resources and possibilities and poor in its men and material. If we want to make India great, it is necessary to develop its resources and possibilities and as we develop we shall find employment for more Indians and more British in our constructive work. Take the mining industry in which we are so vitally interested. If we want to develop mining industries it will be necessary for you to have more efficient foremen and supervisors at as reasonable a remuneration as possible. It will be necessary for you to have experts in the best sense of the word. It will be necessary for you to have better transport arrangements. It will be necessary for you to develop industries from the by-products of coal and from those materials which now run to waste. Examine any of these problems. Attempt a practical solution through the British alone or the Indian alone and you will at once realise the difficulties. Try to solve any of these great problems on lines of mutual co-operation, and you will at once perceive the advantage. Furthermore, if you proceed on lines of mutual co-operation, you will find that if at the present moment the mining industry employs say 500 British,—I am merely mentioning the figure at random—you will be

able to employ 7,500 if you proceed on lines of co-operation. On the other hand, if in the higher and secondary branches of employment the number of Indians to-day be, say, 2,500—here again I am taking figures at random—on the lines I have suggested the figure very soon will be 7,500. Therefore, gentlemen, if we lay down for the two races the standard that I desire to lay down, we shall, I hope, be on the high-road to the solving of many problems that are baffling us for the moment.

Sir, with your permission, I propose to refer shortly to the general political situation of the country. It is true that to the passing observer the sky is overcast with lowering clouds. It is true that to some there is no sign of day-light, but, to my eyes a different picture is visible. Few realise better than I do the dangers ahead, and yet I have not lost my optimism. It is very necessary, Gentlemen, for all of us, British or Indian, seriously to attempt to grapple with the economic situation in India. Instead of quarrelling over the comparatively small differences we have, let us try to produce more and divide the surplus. If the British and the Indian adopt this line, I trust the promoters of destructive movements, whether in economic strikes, in agrarian bitterness or in acrimonious political agitation, will very soon find their own level just as water does.

Gentlemen, if we, British Indians, seriously take up my suggestion, I trust the time may come when we Indians will realise our goal, that is "Liberty." I do not know whether that time will come, for so much will depend on how the Britisher and the Indian conduct themselves in the future. I venture to state in all humility that if my line be accepted by both races, it will be possible when the time comes for the British of future

generations—who like many of you will make India their second home for the best parts of their lives—to be citizens of India. If that development can be achieved—and why should it not be achieved for the world is progressing rapidly?—then it will not be necessary to develop self-Government in India on purely racial lines. If the United States of America can assimilate the Russian Jew, the Austro-Hungarian the Slav and the Italian in their commonwealth and citizenship, I see no reason why the British who have done so much for India and for whom India has done so much, should not be assimilated as fellow citizens of the future commonwealth of the federal states as a part of the Federal British Empire. Gentlemen, perhaps I am dreaming, but it is for us British and Indians to make this dream a reality.

Sir, I feel I have trespassed on your time long enough and I owe an apology to you all. I have not perhaps touched upon any of the practical problems on which you expected me to speak. My first reason for the omission is that I am new to my office, my second reason is that I am not in charge of industries and industrial education, and my last reason is that our Government as a Government is new. But if I have not touched upon any of your immediate problems, I trust I have tried to find for you a key for the solution of many of your future problems, and, Sir, you will perhaps allow me to add, responding as I do to the toast of the Government of Bengal, that my limited experience tells me that *that* Government always tries its utmost to base itself on the co-operation and good-will of both the races; whether it succeeds or not and whether in future it will succeed or not, it is or will be for you all to judge. (Applause).

Proposing the toast of “The Chief Guest,” the Presi-

dent said no man was better known to the mining community than Sir Robert Highet. Sir Robert came out to this country in 1885 as Assistant Engineer to the East Indian Railway Company. Ten years later he was posted to Asansol as District Engineer. This was at a time when the mining industry was beginning to make itself felt. Just about that time he (the speaker) came to this country and in those days one often got a man's reputation before he met him. Very soon he heard about the District Engineer of the East Indian Railway in connection with colliery sidings. The general gist of the information he learned about the then Mr. Highet was to the effect that in social life and in business he was one of the very best. (Hear, hear). When they wanted a colliery siding it was to Mr. Highet, they had to apply. It took a long time to get a siding (laughter) but they did get it, and that was something to be said in his favour. The industry was then in its infancy. The railways did not realise for a long time that coal was necessary for their requirements (laughter). Welsh coal was then being brought into Bombay in steamers; it cost nothing to bring out and for a long time it regulated the cost of Bengal coal. It was not uncommon to hear the railways saying in those days that they wanted coal for locomotives—not stone (laughter). However, days had changed and Bengal coal had now taken its place. In those days the Bengal collieries reckoned their output in maunds—not tons—that was probably due to commercial houses in Calcutta (laughter). Shortly after Sir Robert's residence in Asansol the coal-fields rapidly developed and it was in a great measure due to his work and enterprise that the line was extended from Balaghat into Jharia. Many of them knew the rapid development that occurred in the Jharia

field when the line was extended into it. Many people in those days were quite optimistic about the coal industry. It was told him that several people had taken up large areas in the Jharia coal-field for a mere song, yet when it was put up to the financiers in Calcutta they would not touch it. In those days they were in the same position as they were to-day, on account of wagon shortage. It was not only the sidings; when they got the sidings they could not get the wagons. That reminded him of the story told by an old "*Koi Hai*" of the way in which an old colliery manager solved a railway problem. He was not very experienced in colliery work—of course, that did not matter in those days (laughter)—and he sent a request to Calcutta for a winding machine. This was rather a "stunner" for Calcutta but they ultimately sanctioned it. The engine was ultimately despatched and, having been lost for three months on the railway, it eventually arrived. It was then found that the truck had no doors and the question arose how to get it out. The problem was solved by this ingenious fellow by cutting the bottom out of the truck. (Laughter). The trouble to-day was not taking things out of the truck but putting them in. They had not yet discovered the means whereby they could properly load a covered wagon. They hoped that some time the railway officials would realise that it was almost impossible to load these and they hoped that in the near future they would disappear from the colliery sidings. Sir Robert had travelled a long way since those days and was now at the top of the tree. It was unnecessary for him to go into Sir Robert's career as many in Calcutta were acquainted with it. The President referred to Sir Robert's activities during the war. He carried out his strenuous work and other things besides for if they looked

up the record of the C.V.R. they would find this record 'Robert Highet, Private' (applause). He was able to show the young men of Calcutta what it was to do something for one's country. He hoped Sir Robert would live to see another very large expansion which would be due very much to his energies and personal knowledge. Sir Robert had now got surveys going into an entirely new coal-field and, if present results held good, it would turn out to be a coal-field of greater magnitude than even that of Jharia. They hoped that before Sir Robert severed his connection with railways he would see this project through and see the fruits of his endeavours (applause).

Replying to the toast, Sir Robert Highet said :—

This is not the first time that I have had the good fortune to enjoy your generous hospitality, but on former occasions I was content to take a lower place at your board, and, while fully appreciating the honour of being asked to come up higher, it has the disadvantage of involving a speech.

I thank you, Mr. President, for the very kind manner in which you have referred to a period in my life when I was very closely associated with a certain section of the Mining community, but being neither a Mining Engineer nor a Geologist, I was somewhat disturbed when I found that I would be expected to propose the toast of "The Mineral Industries of India." The subject is, however, one which provides material for other than purely technical matters, and when responding to this toast a year ago Mr. Pattinson confined his remarks to a sweeping condemnation of transport facilities, a subject with which I may claim to have some knowledge. I do not know why Mr. Pattinson should have feared that his remarks would be resented by the railways, as we are, unfortun-

ately, unable to dispute the assertion that transportation services are inadequate, and I am personally prepared to go further and admit that the want of adequate transportation has helped to retard the development of the mineral resources of the country. But I do not agree with Mr. Pattinson in thinking that this is due to want of traffic management based on the experience obtainable in other countries. The few instances which he gave of undue delays in transit were altogether exceptional, and without going into details, I can assure you that the work which we get out of our wagons in India compares very favourably with other railways in the world, and so far as management is concerned, we have little to learn from other countries. If this were not so, is it likely that the large number of railway officers, who had obtained their experience in India, should have risen to such high positions when employed in railway transportation in other countries during the war ?

Sir Robert then told a story which Mr. Pattinson had narrated to him that evening. Mr. Pattinson, he said, was travelling in America and, in the neighbourhood of Chicago, he came across another colliery proprietor. In the course of conversation, Mr. Pattinson narrated his grievances in regard to the difficulty of transport of coal and the American said : " Well, stranger, what is your grievance ? " Mr. Pattinson replied : " I have a colliery 150 miles from the sea-board and it takes five to six days to get wagons down." The American replied : " Well, stranger, I have a colliery a less distance and it takes ten days."

But when, as in his evidence before the Railway Committee as Chairman of the Indian Mining Association, Mr. Pattinson attributes the present unsatisfactory con-

ditions in regard to transport as being the result of parsimonious policy on the part of Government in providing the necessary funds for the provision of adequate facilities and additional rolling stock, he is on surer ground, and, as he very rightly points out, the only remedy is money.

I will not weary you with the details of the numerous schemes for additional facilities which have been put forward from time to time, and which were unduly delayed, or altogether turned down, by Government for want of funds, but I have no hesitation in saying that if these schemes had been sanctioned when they were first asked for, the East Indian Railway would have been in a vastly better position to-day to deal with its traffic, and further, that if money for the facilities which are now admitted to be necessary is not forthcoming, no improvement will be possible.

But this parsimonious and obstructive policy on the part of Government in regard to railway development is not new in the history of the East Indian Railway, and since the line was taken over in 1880, it has always been a hard fight to obtain money for new works and additional facilities.

It may not be known to many of you that a proposal to extend what was then known as the Barakar Branch across the Barakar River was put forward in 1886, and, although it received strong support from the Board of Directors, the Government, after considering the project up to 1889, refused to sanction it. Notwithstanding this decision, the then Chairman of the Board, Sir Richard Strachey, who was then on a visit to India, deputed Mr. T. H. Ward to examine and report on the prospects of the Jharia coal-field, and although field-work was not

commenced till March 1890, it was finished in August of the same year. I think you will all admit that this was a remarkable piece of work and as Mr. Ward's report established beyond question that the coal-field contained a large quantity of very valuable coal, Government was again asked to sanction the extension of the railway across the Barakar river; this was again refused. The Board of Directors were therefore obliged to take the matter up to the Secretary of State and as a result of this the project was eventually sanctioned in March 1892, that is six years after it was first put forward. I mention this as an example of the difficulty which railways have to contend with, and incidentally showing that a Board of Directors in London can sometimes afford assistance in furthering developments.

When Sir George Godfrey proposed the toast of the Mineral Industries of India at this dinner in 1919, he drew a wonderful picture of the possibilities of mineral development and industrial progress, but he said that to make his vision a fact two things were essential, viz. capital and transport. In regard to the former, he evidently referred to the money that would be required for the development of minerals and industrial enterprise, and for this I think there has been a fairly liberal response. I lately had the opportunity of being shown over the work, which the Indian Iron and Steel Company are putting down near Asansol, and was astonished at their extent and possible capacity. When these works are in full operation this must result in a very large addition to the transportation which the railways are unable to cope with successfully at present. We hear rumours that the coal in South Karanpura has been proved to be of excellent quality, and that, in capacity, the field will equal

the output of Jharia. We also hear of the discovery of valuable deposits of iron ore in the same neighbourhood, and if Mr. Marshall's expectations as stated before the Railway Committee are realised, we should, within reasonable time, be able to obtain ample supplies of pig iron at reasonable rates, to be followed later on by rolling mills that will produce sufficient quantities of rails and structural sections to meet all requirements of this country, and leave a considerable surplus for export.

But, personally, I should hesitate to sink capital in an enterprise of this nature without an assurance from Government that the transportation facilities will be made adequate to meet, not only present requirements, but also the further development in regard to mineral and industrial enterprises. You have all no doubt read what Mr. Watson Smyth said before the Railway Committee about the present position regarding manganese ore traffic, and also the estimate made by Mr. Marshall of Tata's in regard to the immediate necessity for railway development to deal with the additional traffic in connection with new industries which may be expected to come into operation in the early future.

But where is the money to come from? Gentlemen, it seems somewhat inconsistent that while being unable to give you any hope of an immediate improvement in railway transportation, I should be asked to propose the toast of "The Mineral Industries of India," but if sufficient funds are forthcoming there is no reason why the railways should not be able to meet all requirements at an early date. Gentlemen, I give you the toast of "The Mineral Industries of India."

Replying to the toast, the Hon. Maharajadhiraja of Burdwan said :—

Not being a mine owner or a mine worker but only a landlord of some of the lands above and below the surface, where some of Bengal's mineral industries are, it is somewhat difficult for me to reply to the toast of the Mineral Industries of India; nor again am I an expert on mineralogy or conversant with the details of these great industries in India. Consequently I shall have to limit my remarks to the possibilities of such industries in Bengal.

In our part of the world, as you all know, the coal mining industry must be given the place of honour, and next to it, we must place iron. My own feeling of course has always been that the resources of Bengal have not yet been properly tapped, and that there are greater possibilities in store for us, but let us, Gentlemen, see what obstructions at the present moment there are, first, with regard to existing industries, and secondly, with regard to tapping the country further in search of other valuable metals and minerals.

Regarding existing industries, the three main difficulties to my mind at the present moment are:—

1. The difficulties of transport.
2. The growing difficulties of labour.
3. And last but not least, the wage trouble and other difficulties with labour, fomented by agitators and persons posing as leaders of very nebulous Trade Unions or Labour Associations.

With regard to the first question, Mr. J. H. Pattinson, in those days an Hon'ble and not an M.L.C. of modern times, pointed out very forcibly in his speech in responding to the toast of the Mining Industries in India at your Annual Dinner last year, what the difficulties were with

regard to transport. It is more than surprising to me that those difficulties should still continue, especially when a man like Sir Robert Highet, once the moving spirit of the East Indian Railway, and now a powerful Director of the same concern and the mover of the Toast to which I am responding, should not have been able by now to make things easier than they were. I am sure that after to-night, he will make a special effort to induce his brother Directors and some of the slow-to-move and not-always-very-quick-to-grasp minds at the headquarters of the Government of India, to realise how much they are hampering the progress of one of India's greatest industries and certainly the greatest in Bengal, by not being able to meet the situation fully.

Turning to the question of the growing difficulties of labour you are fully aware of the position, but may I as a friend and one not entirely disinterested—for a landholder and a proprietor can never be such—say that, whilst it would be a mistake to give in to every demand or to close in as soon as a clamour is made, you must realise, not only the political changes in the country, but the acute economic stringencies through which we are passing, and by giving your labourers more contentment by more liberal wages, you not only minimise the labour troubles, but cut away the ground from below the feet of those behind the wage-earners, whose object is not above suspicion and is not merely true friendship for the wage-earners (applause).

If you can do this, you will indeed have a strong case against those who are getting up strikes, making work in the collieries and other industrial centres difficult, and, in places well-nigh impossible; you would indeed have a strong case to bring before the authorities to deal

efficaciously with these wire-pullers, among whom, whilst there are quite a number of well-meaning and well-intentioned men, there are not wanting unprincipled and unscrupulous fellows also.

I shall now pass on to the question of further development and research in connection with these industries in Bengal, and in this respect I shall only say a very few words. Thanks to an excellent tradition in the estate of which I happen to be the present proprietor, and to the excellent training by a father and guardian, to whom I owe all, I have never been a landholder or a *zemindar* of the type which tries to grasp and swallow the whole pudding. This swallowing of the whole pudding business cannot last whether it be with *zemindars* or directors of companies. To make fortunes in future, you have got to spread out more, and to take in more partners in the business, and I hope, therefore, that owners and proprietors as well as budding companies and their directors will bear these principles in mind when starting to explore fresh fields for newer industries in Bengal.

In conclusion, Gentlemen, I thank you all, and especially my old and esteemed friend Sir Robert Highet for the kind way in which he has proposed this toast and for the way you have responded to it.

Mr. G. C. Webster gave "The Guests." He said that last year, for the first time in their history, they were honoured with the presence of an Indian; this year they had gone further and the Government of Bengal was represented by two Indian spokesmen. They ought to feel deeply honoured that these gentlemen had left the Council Chamber to attend the dinner. They had troublous times ahead, but while they had men of the type of their guests at the head of affairs, all sections of the com-

munity, British and Indian, could safely leave issues in their hands. In conclusion Mr. Webster suggested to the Press that the meetings of the Institute might be more fully reported than had been the case in the past.

Mr. S. C. Stuart Williams, replying put in a plea for co-operation. Some years ago, he said, they were faced with the same difficulties of transport. Everybody seemed to work on their own lines; the railways constructed wagons irrespective of the arrangements at the port, the Trust devised their loading arrangements independent of the railways, and the shipping companies seemed to send in any old ship. He thought they might endeavour to get a little more co-operation in this way. When they read about an arrangement in America whereby they could load a ship of 5,000 tons in three or four hours, and in India they could not get anywhere near it, they felt that it was a definite problem. With regard to the difficulty of getting coal into covered wagons, his difficulty was to get it out (laughter). So far they had not solved the problem. Mr. Stuart Williams mentioned that Sir Robert was once his chief, and that it was with peculiar pleasure that he responded to the toast.

The President distributed medals to prize winners.

Mr. R. R. Simpson, in thanking the President for presiding, said :—

Gentlemen.—It gives me pleasure to propose the health of Mr. George Miller, our new President. Mr. Miller is an original member of the Institute. He has read papers at our meetings and taken an active part in our discussions. He deserves well at our hands, and we have done well in electing him to guide the fortunes of the Institute during the coming year.

Mr. Miller is the third of our presidents hailing from

Scotland. One of the most notable qualities of the men of that northern land is tenacity of purpose, and with that attribute our President is richly endowed. We may expect, therefore, that our corporate interests will be pursued with vigour during his tenure of office, and in that endeavour we wish him the success which he deserves.

Gentlemen, I ask you to drink with me the health of Mr. George Miller, our President.

The President, replying, said it was nice to hear the words with which Mr. Simpson proposed his health but whether it was due to his having just presented him with a medal it was difficult to say (laughter). He could only say that while the reins of office were in his hands he would do all he could to make the Institution prosperous. He hoped that during the year they would have plenty of meetings which would not only be pleasant but also instructive; also that at the end of the year they would be much stronger than they were now.

This concluded the proceedings.

INSTITUTE MEDAL.

In 1916 it was decided that medals—gold, silver and



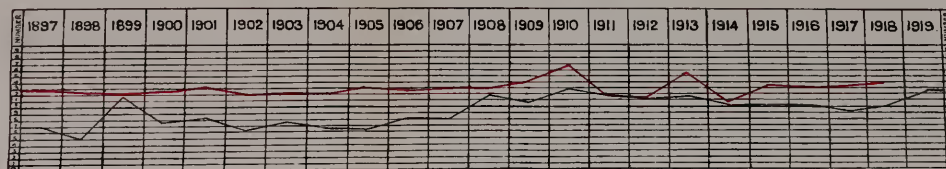
bronze—should be awarded to authors of the three best papers read before the Institute and published in the

Transactions. The awards were delayed up owing to the difficulty in finding suitable die-sinkers. The Council at last decided that the medal should be designed and prepared on the Continent. Advantage was taken of the fact that Lt.-Col. F. Cunynghame Hughes' was going on leave last year, and he kindly undertook to arrange for the striking of the medal. The design, a facsimilie of which is reproduced, was the work of Monsieur René Baudichon, of the Paris Mint, the medal being prepared at the Paris Mint.

List of Medal Winners.

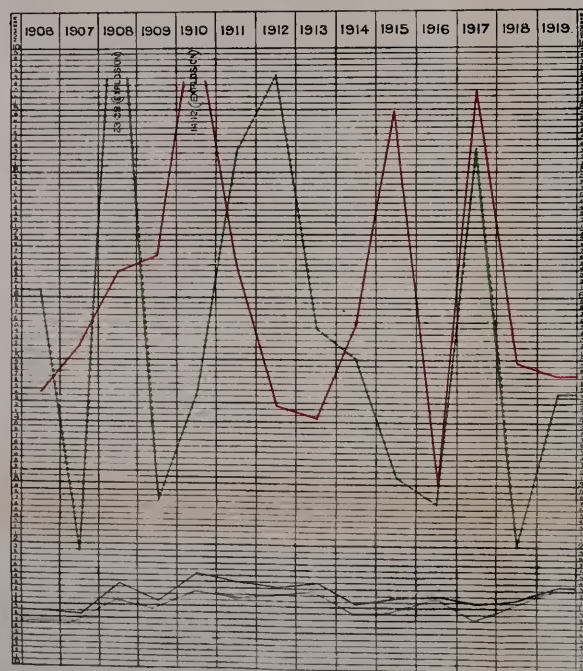
	1916.	1917.	1918.
Gold Medal	.. F. L. G. Simpson.	C. A. John Hendry.	E. H. Robertson.
Silver Medal	.. Glen George.	Dr. L. L. Fermor.	E. J. Beer.
Bronze Medal	.. E. H. Robertson.	J. H. Evans.	G. H. McCale.
	1919.	1920.	
Gold Medal	.. J. Brown.	E. H. Robertson.	
Silver Medal	.. C. A. John Hendry.	H. M. Tarlton.	
Bronze Medal	.. G. W. Marshall.	R. R. Simpson.	

Showing Death-rates per Thousand Persons employed in all Indian Mines & in Coal Mines in Great Britain.



REFERENCES—
All Indian Mines (India) — Coal Mines (Britain)

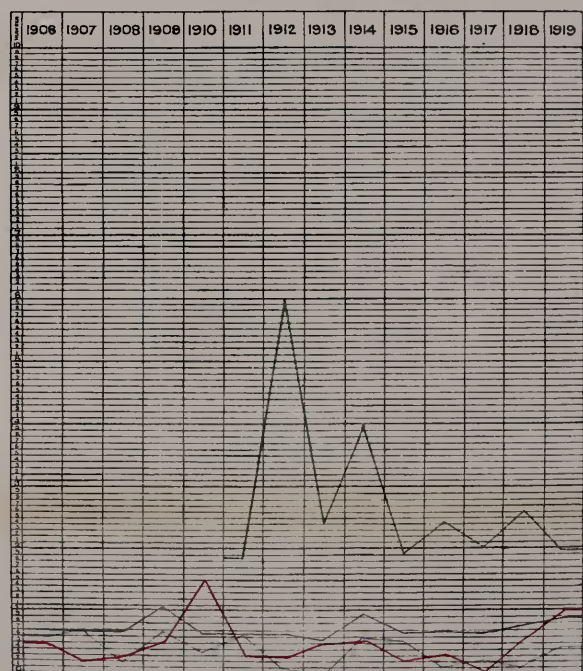
Showing Death-rates per Thousand Persons employed in Coal Mines in India.



REFERENCES—

All Coal Mines — Mines in Assam (Lakhimpur) —
Mines in Bengal and in Bihar and Orissa — Belachistan

Showing Death-rates per Thousand Persons employed in other than Coal Mines in India.



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All Mines other than Coal Mines — Nonmetallic Mines —
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